

PRIMARY CARCINOMA
OF THE LUNG
IN
BANTU MINERS.

An Anthropathological Study in
the Aetiology of the Disease.



by

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I N T R O D U C T I O N .

Bronchogenic Carcinoma of the lung in Europeans is now a common disease, whilst it is rare in the Bantu races of South Africa. The writer has been associated with the Silicosis Medical Bureau for the past fifteen years and has checked up all the records since the inception of the Bureau in August 1916. Nearly every miner, even if he leaves the mines, has a post-mortem examination and the lungs are forwarded from all parts of the Union of South Africa to the Bureau for examination. As the Chairman of the Silicosis Medical Bureau (15) writes in the 1944-1948 Report:-

"Under the Silicosis Act it is in the interests of the dependents of a miner that an autopsy should be performed on his death and the lungs forwarded to the Bureau for examination. There are indeed very few cases in which no post-mortem examination is conducted."

A full definition of the Bantu races will be given in the Chapter on "History and Anthropology" when it will be noted that they include all the Native tribes of Southern Africa with the exception of the Hottentots and Bushmen. In South Africa, they are also referred to as "Africans, Natives or Kaffirs".

The arguments used in this thesis are mainly based on the clinical histories and post-mortem find-

ings in 6 Bantu cases of "Primary Carcinoma of the Lung" in 11,365 post-mortems of Bantu miners as compared to 114 cases of "Bronchial Carcinoma" in 8,468 post-mortems of European miners, all conducted during the period 1916-1949.

Bronchial Carcinoma is also uncommon in Bantus who are not miners. (See Chapter V. Table 12).

Amongst the Bantu miners during the period 1925-1933, Charles Berman (8) found 229 cases of "Primary Carcinoma of the Liver". The same group of Bantu miners show a high incidence of "Primary Carcinoma of the Liver" and a low incidence of "Primary Carcinoma of the Lung".

In this thesis, an attempt will be made to discuss the aetiology of "Primary Cancer of the Lung", mainly from an anthropathological viewpoint and to try and explain why in a city like Johannesburg, where in terms of the international recommendations, accurate statistics are kept by the health authorities, primary cancer of the lung is about ten times as common in the European as it is in the Bantu.

A C K N O W L E D G M E N T S.

The writer wishes to thank Dr. A.S.W. Verster, (Chairman of the Silicosis Medical Bureau) and Mrs A.S.W. Verster, B.A.(Rand) for reading over the thesis and to express his deep appreciation to the librarians of the Witwatersrand University Medical Library and the South African Institute for Medical Research for obtaining for him the reports, medical journals and books mentioned in the bibliography and for their ever ready help and courtesy.

His sincere thanks are due to Mrs. C.E. Clayson for typing this thesis and to his radiographer Mr. W. Finch, who is responsible for the photographs and radiographic reproductions. He is indebted to the "Compound Manager " of the Witwatersrand Native Labour Association for the facilities that were given to photograph the models of the principal Bantu tribes.

C O N T E N T S.

| | <u>Page.</u> |
|---|--------------|
| <u>C H A P T E R I.</u> | |
| HISTORY AND ANTHROPOLOGY... .. | 1 |
| <u>C H A P T E R II.</u> | |
| ENVIRONMENT AND DIET. | 7 |
| <u>C H A P T E R III.</u> | |
| HEALTH SERVICES FOR THE BANTU MINER ... | 15 |
| <u>C H A P T E R IV.</u> | |
| A STUDY OF 6 CASES OF PRIMARY BRONCHOGENIC CARCINOMA IN THE BANTU MINER COMPARED WITH 114 CASES IN EUROPEAN MINERS | 25 |
| <u>C H A P T E R V.</u> | |
| RACIAL FACTOR IN THE AETIOLOGY OF THE DISEASE... .. | 47 |
| <u>C H A P T E R VI.</u> | |
| EXTRINSIC FACTORS IN THE CAUSATION OF THE DISEASE | 72 |
| <u>C H A P T E R VII.</u> | |
| SUMMARY AND CONCLUSIONS | 106 |
| <u>APPENDIX.</u> 114 CASES IN EUROPEAN MINERS ... | 110 |
| <u>BIBLIOGRAPHY</u> | 303 |

Comparative racial pathology deserves not only to be the subject of a separate field of investigation and study, but also a separate name for its designation. It is suggested that this subject be known as "anthropathology".

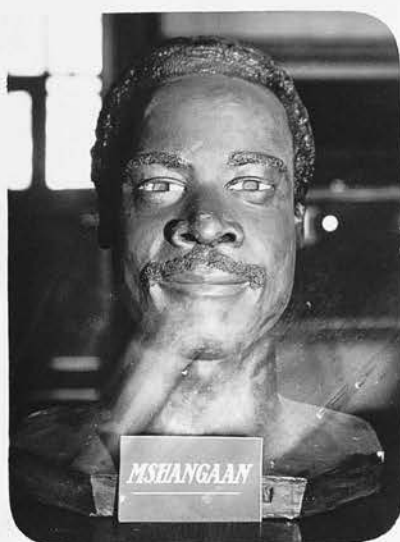
J.H. LEWIS

Major forms of cancer are largely the result of human habits and an intelligent reformation of the habits of the race must be accomplished before cancer prevention can show any tangible results.

JAMES EWING.



TYPICAL HEADS OF THE PRINCIPAL BANTU TRIBES.



TYPICAL HEADS OF THE PRINCIPAL BANTU TRIBES.

C H A P T E R I .

HISTORY AND ANTHROPOLOGY.

The Bantu race consists of persons of the various Bantu tribes of Southern Africa.

The figures given below (See Table I.) are taken from the 1949 publication of the Census and Statistics department of the Union of South Africa (13).

The chief Bantu tribes are the Zulu, Basuto, Xosa, Pondo, Barolong, Shangaan, Mchopi, Nyambane, Fingo, Bechuana, Tembu, Swazi, Tonga and Mozambique.

The comparative figures of the number of Europeans and Bantu in the Union of South Africa are as follows:-

TABLE I .

POPULATION OF THE UNION OF SOUTH AFRICA

EUROPEAN .

| <u>Year.</u> | <u>Persons.</u> |
|--------------|-----------------|
| 1865 | 181,592. |
| 1891 | 423,775. |
| 1911 | 1,276,242. |
| 1921 | 1,519,488. |
| 1946 | 2,372,670. |

TABLE I. (Cont.)BANTU.

| <u>Year</u> | <u>Persons.</u> |
|-------------|-----------------|
| 1891 | 1,294,119. |
| 1911 | 4,019,006. |
| 1921 | 4,697,813. |
| 1946 | 7,831,915. |

ASIATICS (mainly Indians)

| | |
|------|----------|
| 1946 | 285,260. |
|------|----------|

"COLOURED PERSONS" (persons of mixed descent, usually Eurafrican).

| | |
|------|----------|
| 1946 | 928,484. |
|------|----------|

Total Population of the Union of South Africa on 7th May, 1946:-

11,418,349.

At the Annual meeting of the Transvaal Chamber of Mines held on the 26th June, 1950 the Chairman (16) reported that the Bantu labour force for 1949 was 313,766. These were recruited approximately as follows:-

| | |
|-----------------------|---------|
| East Coast Natives | 80,000 |
| British South African | 200,000 |
| Tropical Boys | 40,000. |

Thus, nearly two-thirds of the Bantu miners are

recruited from areas within the Union of South Africa of which the largest number come from the Transkei and Ciskei areas of the Cape Province. Many Bantus come from the three British Protectorates, Bechuana-land, Swaziland and Basutoland, whilst a smaller number come from Zululand and the Northern Transvaal.

All these Natives are referred to as British South African. These labourers contract for 270 worked shifts and this usually means a period of nine to twelve months at a time.

Over twenty-five percent of the Native labour force is obtained from Portuguese East Africa and consists mainly of the Mchopi, Nyambaan and Shangaan tribes. Natives desiring employment on the gold mines proceed to one of the many stations maintained by the Witwatersrand Native Labour Association, Portuguese East Africa. The Natives are transported to Ressano Garcia, a railway station near the Transvaal border and from there special bi-weekly trains convey them to the main depot and hospital in Eloff Street Extension, Johannesburg. Half the money received by these Bantu miners is paid to them on their return to Portuguese territory. In practice this means that a considerable income is received by the Portuguese Government.

These miners usually work for a period of one year. In terms of a special convention, the Bantu miner must at the end of one and a half years (469

shifts) return to Portuguese territory. The organisation is such that any Native may be able to return home, within twenty-four hours of his leaving the Witwatersrand Native Labour Association station in Portuguese territory.

Bantus from Southern Africa, south of the Equator but north of Latitude 22° South are classified as "Tropicals". These constitute from ten to fifteen percent of the Bantu labour force and in 1913 their introduction into the Union for employment on the mines was prohibited owing to their susceptibility to pneumonia. Thanks to recent advances in the treatment of pneumonia, Tropical Natives are again being recruited in fairly large numbers.

The history of Southern Africa is almost entirely modern. Eric A. Walker (96) is of the opinion that the Zimbabwe ruins in Southern Rhodesia was the work of the Bantu people whose descendants are the Bavenda and Barotse and that its origins date back possibly to the ninth century A.D. We have no historical information of any events before this period. Between the tenth and fifteenth centuries we find that a number of Arabs of North Africa and Asia invaded the East Coast of Africa but they had little influence on the Bantu races of Southern Africa. Whilst one finds numerous Natives in East Africa who profess

the Mohammedan religion, the Bantu races have never had any association with this belief. in 1497 Vasco da Gama arrived at the Cape and from that time onwards Portuguese settlements began to appear.

During the fifteenth and sixteenth centuries many Bantu tribes gradually moved into Southern Africa by the way of the Great Lakes of East Africa. The Dutch arrived in 1652 and during the next century Huguenot and British settlers arrived with their missionaries and traders. In 1702, the Xosa tribe crossed the Kei River and in 1778 the Xosa chiefs agreed on a dividing line between white and black territories. The first Kaffir war broke out in 1779 and in the nineteenth century numerous Kaffir wars took place. Today, (1950) most of the unskilled work in South Africa, whether on the gold mines, farms or in industry, is performed by the Bantu.

ANTHROPOLOGICAL NOTES.

Experience with the Bantu miners who are examined at the Witwatersrand Native Labour Association hospital gives the following average measurements:-

| | |
|---------------|-----------------|
| <u>Height</u> | 5 ft. 5 inches. |
| <u>Weight</u> | 130 pounds. |

CHEST MEASUREMENTS.

Normal 32 inches

With Forced Inspiration. 34.8 inches.

Cranial Capacity . 1485 ccs.

The average European miner is 5 feet $7\frac{1}{2}$ inches high, weighs 150 lbs, and the corresponding chest measurements are 36 inches and 39 inches and he has a cranial capacity of 1500 ccs.

The skin of the South African Bantu is essentially black, from melanin pigment in the skin, but it may vary from black to yellowish brown. His hair is short and woolly, his nose generally low and broad, whilst the head is usually described as being of the dolichocephalic type.

C H A P T E R I I .

ENVIRONMENT AND DIET.

Practically all the Bantu miners are recruited from the rural areas and return home both in the periods between the yearly contracts and finally when for various reasons they do not wish to continue working underground or when they have been compensated by the Silicosis Medical Bureau.

Whilst at the mines the Natives are housed in compounds or barracks and usually sleep 20 in a room. During their working hours they labour underground and the conditions there, on the whole, are similar to those of the European. The Bantu miner spends the greater part of his life in the country, where apart from the cash income that he brings back with him, he does little to earn more by improving his agricultural production. The Natives spend most of their day out of doors and they live in huts which are arranged to form what is known as a "kraal". These huts are either of the dome or bee-hive type and a basket framework is made of woven boughs and plastered inside and outside with a mixture of mud and cowdung. These huts are usually about 20 feet in diameter, $5\frac{1}{2}$ feet high and have a small door but no windows. The floor is often hardened with ant-heap and a fire is usually kept

burning all night, the fireplace being situated in the centre of the hut. At night grass mats are placed inside the huts and the Natives usually sleep with their feet as near to the fire as possible. Often 6 persons occupy one hut and the inside of most roofs is covered with soot and vermin.

The diet of the rural Bantu consists mainly of mealies (maize) or kaffir-corn (millet or sorghum), mfino (wild spinach) and occasionally other vegetables such as pumpkins, peas and beans, small quantities of meat and milk and kaffir-beer. The diet is monotonous but inexpensive.

The mealie meal is the staple article of diet and is much more filling and satisfying than rice. Green mealies are sometimes boiled or roasted on the cob, but more generally the shelled grains are boiled in water until they are soft and are then eaten as a porridge. In some areas kaffir-corn is preferred and in this case the millet is usually stamped or ground and then stirred into boiling water to make a stiff porridge.

Cattle are seldom slaughtered and are frequently kept in order to buy wives and as polygamy is the rule, the number of wives a Native has is determined by his wealth. The women not only do a good deal of

work but their children are regarded as precious assets, especially as owing to a high infant and child mortality rate only about 50 per cent of the Bantu children reach 18 years of age.

The Bantu submit that kaffir-beer is a national beverage, has nutritional value and is inextricably connected with their social and religious life. Moreover, it can be made at home at a cost of less than sixpence a gallon. The Natives begin drinking beer at an early age and that made from Kaffir-corn contains from 2 to 4 percent alcohol. A drink known as "Marewu" is only slightly alcoholic and is a light sour drink made from fermented mealie meal. One pound of mealie meal will give about a gallon of marewu and if small quantities of flour are added fermentation takes place at a much faster rate.

Thus the average diet of the rural Bantu is unbalanced and is inadequate in quantity but he nevertheless manages very well and only in a few cases is it necessary to build him up with suitable foodstuffs before allowing him to work underground.

On the mines the Bantu labourer receives a balanced diet and the following tables show the usual rations given to the Bantu miners and the minimum ration scale demanded by government regulations.

The following table by Orenstein (67) shows the daily allotment of the various food components, their composition, total energy value and vitamin content.

TABLE 2.

RATION SCALE FOR NATIVE LABOURERS (A.J. Orenstein)

Symbols used in Vitamin table 0 = absent
 + = present
 ++ = present
 in quantity

| ARTICLE | Minimum Daily Allow- ance (ozs) | Energy Value Calor- ies | VITAMINS | | |
|------------------|---|----------------------------------|-------------|----|--------|
| | | | A. | B. | C. |
| Mealie Meal | 24 | 2568 | 0 | + | 0 |
| Bread | 6 | 441 | + | ++ | 0 |
| Beans or Peas | 1.5 | 145 | + | ++ | ? |
| " Germinated | 1.5 | 145 | 0 to + + | ? | ++ |
| Meat | 6.85 | 470 | + | ++ | 0 to + |
| Soup Meat | 1.7 | 145 | + | ++ | 0 to + |
| Peanuts | 2 | 241 | + | ++ | ? |
| Sugar | 1 | 116 | 0 | 0 | 0 |
| Vegetables | 5 | 80 | + | + | + |
| Salt | .5 | - | 0 | 0 | 0 |
| Cocoa | .25 | 34 | 0 | ? | ? |
| Kaffir-beer | 16 ozs twice weekly | - | 0 | ? | ? |

Total Energy Value = 4385 calories.

Whilst most of the mines allow a similar ration of over 4,000 calories, the government lays down a minimum ration scale for miners. Williams (100) quotes the following two tables. Table 3 shows how the government ration scale is sub-divided to give the minimum of 3864 calories and Williams recommends to the mine medical officers that 7 grams liver (for Vitamin A), 9 grams fat dripping, 56 grams sugar and 24 grams orange juice be added each day to the minimum government ration scale.

Williams (100) compares the government minimum scale and that of the standard allowance compiled by the "Committee on Food and Nutrition, National Research Council of the U.S.A.", and apart from the vitamin content the figures compare very favourably. It is for this reason that most mine medical officers have accepted his recommendation to add liver, fat, dripping and orange juice to the daily rations.

TABLE 3 SHOWING MINIMUM RATION SCALE ACCORDING TO GOVERNMENT REGULATIONS FOR NATIVE MINERS.

| | Daily Allowance per Native in grams. | Protein in grams. | Fat in grams. | Carbohydrates in grams. | Calcium in m. grams. | Phosphorus in m. grams. | Iron in m. grams. | Vitamin A "I" units. | Vitamin B "I" units. | Riboflavin in m. grams. | Nicotinic acid in m. grams. | Vitamin C in m. grams. | Calories |
|--|--|----------------------|---------------|----------------------------|-------------------------|----------------------------|----------------------|-------------------------|-------------------------|----------------------------|--------------------------------|---------------------------|----------|
| Mealie Meal for all pur- poses (24 ozs + 2oz in Bread | 730 | 66 | 29 | 526 | 146 | 1274 | 29 | 146 | 146 | 1.1 | 7.3 | 0 | 2553. |
| Whole Meal in Bread 6 oz. taken at 64 per cent. | 100 | 10 | 1 | 68 | 60 | 46 | 10 | 200 | 120 | 0 | 5 | 0 | 340. |
| Beans (3oz). | 85 | 17 | 0 | 43 | 72 | 263 | 5 | 0 | 85 | 0 | 1 | 9 | 240. |
| Meat (5oz daily). | 140 | 28 | 28 | 0 | 8 | 280 | 8.4 | 0 | 42 | .1 | 8 | 3 | 364. |
| Peanuts (2oz). | 56 | 17 | 27 | 5 | 5 | 147 | 1 | 0 | 112 | .2 | 7 | 0 | 310. |
| Fresh vegetables (5oz daily) | 140 | 2 | 0 | 10 | 47 | 2 | 1 | 620 | 38 | .1 | 2 | 16 | 55. |
| TOTALS | 1251 | 140 | 85 | 652 | 338 | 2012 | 54.4 | 966 | 543 | 1.5 | 30.3 | 28 | 3864. |

TABLE 4 SHOWING COMPARISON OF STANDARD ALLOWANCE
COMPILED BY THE COMMITTEE ON FOOD AND NUTRITION.
NATIONAL RESEARCH COUNCIL U.S.A. WITH GOVERN-
MENT MINIMUM RATION SCALE FOR NATIVE
MINE LABOURERS.

| | Standard Allowance U.S.A. | Government Minimum Ration Scale. S.A. |
|-----------------------------------|---------------------------------|--|
| Protein Total grams | 100 | 140 |
| Animal " | 50 | 28 |
| Fat " | 100 | 85 |
| Carbohydrates " | 300 - 500 | 652 |
| Calories - | 4500 | 3864 |
| Calcium mgms | 1000 | 338 |
| Phosphorus " | 1320 | 2012 |
| Calcium Phosphorus ratio | .76 | .16 |
| Iron mgms | 15 | 54.4 |
| Vitamin A I.U. | 4000 - 6000 | 966 |
| Vitamin B I.U. | 800 | 543 |
| B ₁ /Caloric ratio - | .15 - .2 | .14 |
| Vitamin C mgms. | 30 - 60 | 28 |
| Vitamin D I.U. | ?300- 400 | - |

These rations according to food experts are adequate and the records of the mine medical officers show that vitamin-deficiency diseases are infrequent whilst the vast majority of Natives gain weight whilst employed on the mines.

C H A P T E R I I I .

HEALTH SERVICES FOR THE BANTU MINER.

The health of the Bantu miner is controlled and supervised by four main institutions.

These are as follows:-

- I. Silicosis Medical Bureau.
- II. The Witwatersrand Native Labour Association.
- III. The South African Institute for Medical Research.
- IV. The Mine Hospitals.

THE SILICOSIS MEDICAL BUREAU, was instituted under the Miners Phthisis Act of 1916 and commenced its work on 1st August of that year. Until recently this body was called the Miners Phthisis Bureau and consists of whole-time Government medical officers appointed by the Minister of Mines. Whilst all the pathological and laboratory investigations are carried out at the Medical Research Institute, the Bureau is responsible for all decisions which may be based on such investigations.

The Act provides that all Native labourers in whom a medical examiner finds any sign of chest disease should be sent forward for examination and final disposal by the Bureau. They are clinically examined by a member of the Bureau and the final

decision is taken by that body on the evidence. The Bureau consists of a Medical Chairman, eleven whole-time medical officers, and a part-time radiologist and a technical and clerical staff of thirty. Every miner is examined and x-rayed at six monthly or yearly intervals and the miner is admitted to a hospital if he requires further investigation and treatment.

THE WITWATERSRAND NATIVE LABOUR ASSOCIATION was established in 1901 and has to date supplied the Witwatersrand Gold Mines with over two million Natives. Many of these Bantu recruits had never seen a medical man in their lives and some had never seen a European until the recruiting agent came on the scene. The agent is accompanied by a party of Natives from the mines who explain the advantages of mine work to their compatriots. Many Natives from Portuguese East Africa return to the mines for further periods of service of one year at a time as opportunities of employment in the Province of Mozambique are very limited. The Association employs one hundred Europeans and over one thousand Natives for this work.

In the large hospital, which forms the main unit of the Association's buildings, about one thousand Bantu miners are medically examined each day. In addition to the part-time Bureau doctors there are nine full time medical officers. The clothes of the

Natives are de-verminized in a steam disinfectant, the Native is inoculated and vaccinated and is then examined clinically and radiologically. Eye, ear, nose and throat cases and other conditions requiring specialist attention are treated at this hospital. The most recent addition to this hospital is a large and well equipped physio-therapy department. Over a hundred convalescent Natives whom the mine medical officers regard as unfit for work on the mines are repatriated each week from this hospital.

THE SOUTH AFRICAN INSTITUTE FOR MEDICAL RESEARCH was established in 1912 by agreement between the Government of the Union of South Africa and the Witwatersrand Native Labour Association for the purpose, primarily, of carrying out researches and investigations with a view to the prevention and treatment of human diseases. Under the terms of its foundation it is also required to carry out many routine investigations for the mining industry, more particularly for the health of the great many of the Bantu labourers employed in the mines. The cost of these large and well equipped buildings was borne by the Witwatersrand Native Labour Association. All the pathological and laboratory work mentioned in this book has been carried out by the highly trained and well qualified staff of this Institute. The heads of the many de-

According to the latest report of the Witwatersrand Native Labour Association (73) there are now 37 Native mine hospitals with 60 full time medical officers. The hospitals have a total of 7,500 beds available, thus giving the high ratio of one hospital bed for each of 40 Native labourers.

RADIOLOGICAL SERVICES: European miners are all x-rayed at the Silicosis Medical Bureau whilst the Bantu miners are x-rayed at the Witwatersrand Native Labour Association Hospital and the large films are sent to the Bureau for interpretation. At the Bureau the miners are x-rayed at yearly intervals up to ten years' service and at six monthly intervals after ten years' service. Should any abnormality be noted on the routine postero-anterior x-ray film then the case would be x-rayed at frequent intervals and lateral, oblique, stereoscopic, apical and Potter-Bucky films would be taken if necessary; in many instances the case is referred to a General Hospital for bronchograms, tomograms and kymograms.

The apparatus used at the Bureau consists of two modern shock-proof units capable of delivering 50 milliamperes seconds at 80 kilovoltage peak. The average miner is x-rayed at a twentieth of a second exposure, with 500 milliamperes passing through the tube at a kilovoltage peak of 40 to 60 and at a target

partments are Professors in their particular branch at the Witwatersrand University.

MINE HOSPITALS AND MINE MEDICAL OFFICERS. In terms of the Regulations, hospital beds in the ratio of $2\frac{1}{2}$ per cent of the average number employed must be provided. In practice one finds that there is a hospital for Bantus on each mine. If one takes an average of the admissions of the mine hospital one finds that over fifty per cent are surgical and traumatic cases, about forty per cent suffer from respiratory diseases, five per cent from malaria, dysentery, and other tropical and infectious diseases, whilst under five per cent require specialist treatment and are sent to the Witwatersrand Native Labour Association hospital in Johannesburg.

Government regulations provide that the Bantu employed on the mines, unlike the European miners, who join the local medical Benefit Society, shall receive free medical and hospital treatment during his employment. Full time medical officers are appointed for each mine.

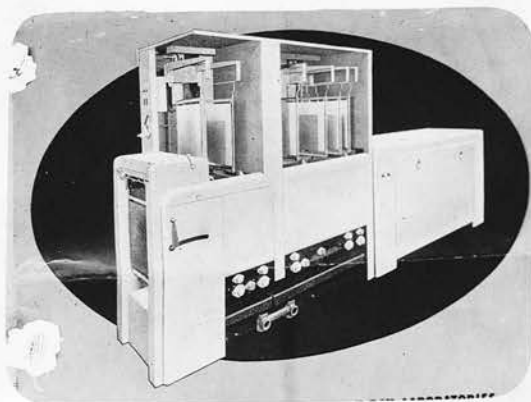
The mine medical officers are responsible for all treatment at the local mine hospital and under the "Miners Phthisis Act" he must carry out periodical examinations of all Bantu miners.

to film distance of 5 feet. Rotating anode tubes are used and in order to x-ray two hundred miners each morning the Bureau has found it more convenient to have the tube stand and cassette-holder fixed whilst the miner stands on a movable platform. A small x-ray unit is used to stencil permanent serial numbers of the miner on the x-ray film and the numbers and date consist of small perforations in a metal stencil and an exposure of a few milliampere seconds registers the number and date over the cardiac shadow.

On the decisions of the Medical Bureau about £7,000 a day is paid out in compensation and every miner is photographed to see that no one substitutes for him and a signed photograph of each miner is pasted on to a red card which informs him when he must appear again for examination. The camera used has a double lens and photographs simultaneously the head and shoulders of the man together with a slip bearing the miner's signature, his permanent number and the date.

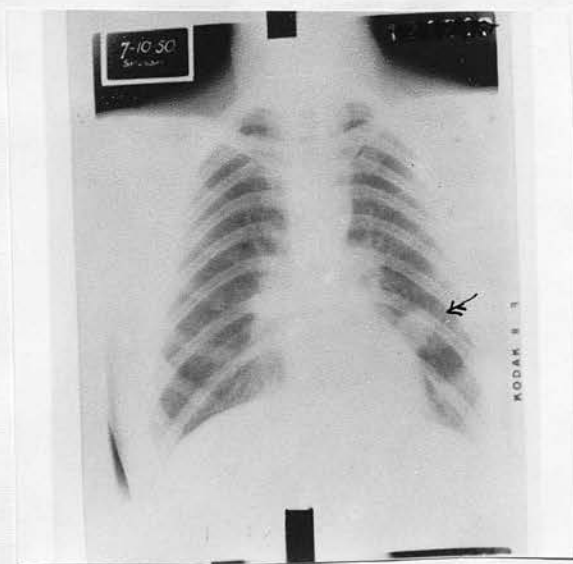
A Pako unit is used to process and dry automatically the x-ray films and to eliminate the factor of human error that may occur in manual developing. As all the x-ray reports have to be completed before the Bureau meets each day at 2.15 p.m. it was previously found necessary to report on wet films which were

placed on 200 viewing boxes and the radiologist had a movable desk to enable him to complete his reports in time. With the Pako unit a film can be developed every minute and it takes exactly one hour to develop, fix, wash and dry each film. Every film is submerged and agitated in each solution for a predetermined interval of time and a special transfer mechanism automatically picks up the hangette holding each film and transfers it from one processing tank to the next and finally from the feeding magazine to the tunnel dryer. A junior assistant places the film-loaded hangettes into the feeding magazine and after one hour he can remove them from the end of the tunnel, and sends them up to the radiologist.



PAKO UNIT.

In addition to the large units the Bureau has two 70 m.m. miniature Photo-Roentgen units. After experiments with 5" x 4" films, paper films, 70 m.m. roll-film, and 35 m.m. roll-film the Bureau decided in 1947 to purchase two 70 m.m. units. As will be seen later 35 m.m. films are used for the Bantu. One 70 m.m. unit is used for x-raying short service miners whilst the "Bus Type" unit travels to out-lying areas. In all cases a large film is taken if any abnormality is seen on the miniature. The following is a print of a 70 m.m. film showing a case of carcinoma of the left lung which was first noticed on this film.



MINIATURE FILM SHOWING OPACITY AT BASE OF
LEFT LUNG FIELD.

Both 70 m.m. units are fitted with 200 milliamperere rotating anode tubes and photoelectric timers and the "Bus Type" unit has a separate trailer in which is mounted a 25 K.V.A. motor generator.

At the Witwatersrand Native Labour Association Hospital, in addition to the large unit which is the same as that at the Bureau, hundreds of Natives are x-rayed each day with the 35 m.m. unit which has been designed by K.G.F. Collender (19). The Bantu miner stands on a platform and the "Lift Gear" designed by H.G. John is so arranged that there are 9 levels or stages with a distance of just under 2 inches between each stage.

The details of the technique used at the Witwatersrand Native Labour Hospital are as follows:-

| | |
|--------------------------------|----------------|
| Tube-Screen distance | 5 feet. |
| Time | .1 second |
| Milliamperage | 160 |
| Rotating Anode tube focal spot | 1 m.m. square. |
| Lens aperture | f/0.85. |
| Kilovoltage (Peak) | \pm 72 |

This plant has now been in use for many years and no difficulty is found in radiographing between 250 and 300 cases per hour.

At the conference on "Silicosis, Pneumokoniosis

and Dust Suppression" the Chairman of the Bureau, (Dr. J.M. Smith, (83) reported that 27 cases of primary carcinoma of the lung had been diagnosed post-mortem by the Bureau from 1941 to 1944 and that only one case had not been diagnosed during life.

CHAPTER IV.

SIX CASES OF PRIMARY BRONCHOGENIC CARCINOMA IN THE BANTU MINER.

During the period from the year 1916 to 1949 the South African Institute for Medical Research reported to the Silicosis Medical Bureau on 19,833 pairs of lungs examined post-mortem. Of the lungs examined 8,468 pairs were from Europeans and 11,365 pairs were from Bantu miners.

The following table gives the numbers examined up to 1938, and from 1938 to 1949 the numbers examined each year are tabulated below.

TABLE 5.

NUMBER OF EUROPEAN AND BANTU MINERS WHOSE LUNGS

WERE EXAMINED POST-MORTEM.

| <u>Years</u> | <u>Number of European Miners whose Lungs were Examined post- mortem.</u> | <u>Number of Bantu Miners whose Lungs were Exam- ined post-mortem.</u> |
|--------------|--|--|
| 1916 to 1938 | 4554 | 5950. |
| 1939 | 375 | 329 |
| 1940 | 389 | 335. |
| 1941 | 376 | 368. |
| 1942 | 375 | 422. |
| 1943 | 385 | 394. |

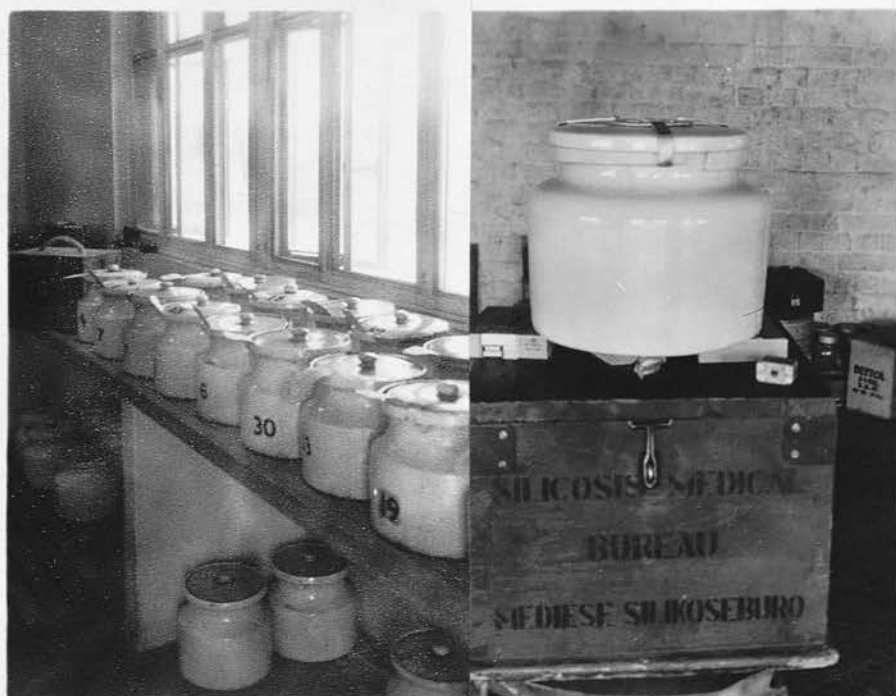
TABLE 5 (Cont.)

| <u>Years.</u> | <u>Number of European Miners whose Lungs were Examined post-mortem.</u> | <u>Number of Bantu Miners whose Lungs were Examined post-mortem.</u> |
|-----------------------------|---|--|
| 1944 | 344 | 476. |
| 1945 | 314 | 634. |
| 1946 | 364 | 657. |
| 1947 | 328 | 541. |
| 1948 | 316 | 648. |
| 1949 | 348 | 611. |
| 1916 - 1949 <u>TOTAL</u> | 8,468 | 11,365. |

Of the 11,365 cases examined post-mortem in Bantu miners six were found to have primary lung cancer and these six cases are described in this Chapter. Of the 8,468 cases examined post-mortem in European miners 114 cases were found to have primary lung cancer and these cases are described in the Appendix and frequent references will be made to them in the following Chapters.

Judging only from these post-mortem statistics the findings in the above table show a proportion of 1 case of primary bronchogenic carcinoma in 75 post-mortems of European miners to 1 case of primary bronchogenic

carcinoma in 1,880 post-mortems of Bantu miners, so that this disease is found to occur 25 times more often in the European miner.



BOX AND RECEPTACLES IN WHICH LUNGS ARE
SENT TO THE BUREAU FOR EXAMINATION.

CASE HISTORIES OF BANTU MINERS.

CASE I.

Underground Service: 7 years.

Report on 3 Specimens of sputa submitted for examination for bacillus tuberculosis. The results of the above examination are all negative.

Report of medical examiner of the Silicosis Medical Bureau (2 weeks before death).

Identifying marks (if any) - Nil.

Reputed Age: ?

Present Weight: Too ill to weigh.

Aspect: Sickly.

Nutrition: Emaciated.

Temperature: 99° F.

Pulse Rate (at rest): 104.

Physical Signs in Lungs:

Percussion: dull note over left base.

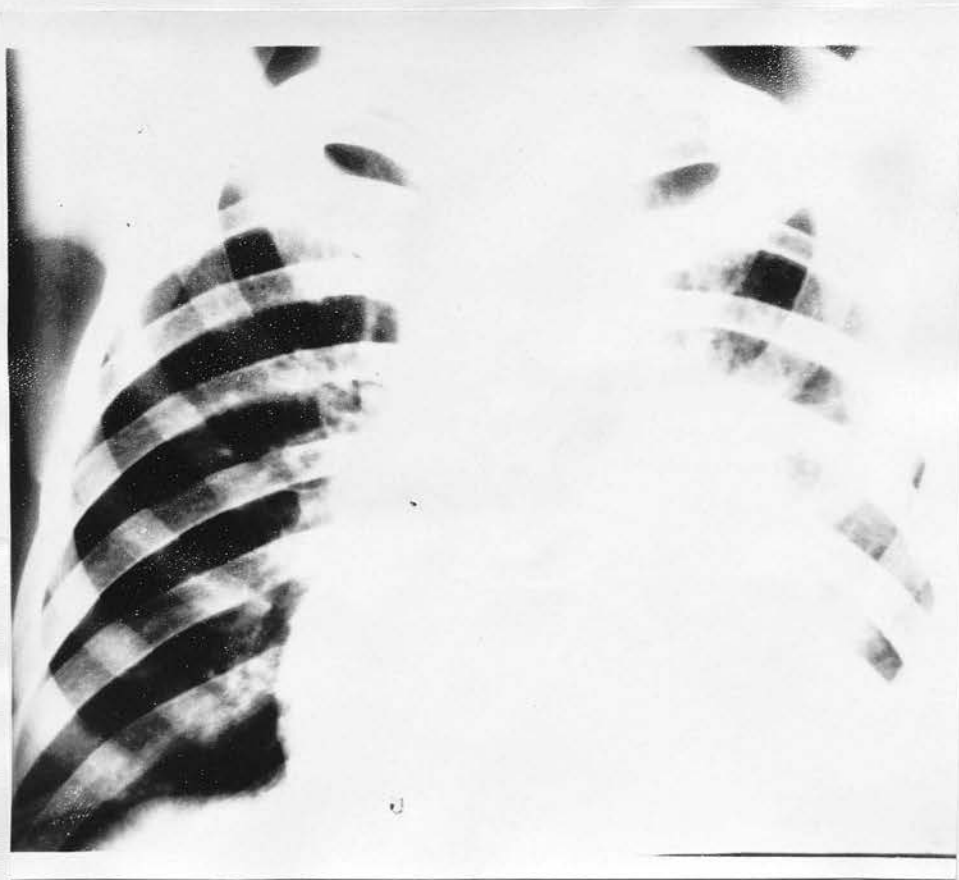
Auscultation: Breath sounds reduced over the left lung
Breathing is broncho-vesicular over the basal half and crepitations are heard over the upper third.

Provisional Diagnosis: Tuberculosis of the left lung.

Radiological Report (2 weeks before death): There is no evidence of silicosis. There is a marked hilar enlargement on the left side and from it an opacity extends both into the upper and lower thirds of the left lung. The appearances in the left lung are either due to tuberculosis or to a primary bronchogenic carcinoma.

Post-Mortem Report:

Right Lung: 450 grams. Left Lung: 470 grams. Heart: 210 grams.



RADIOGRAPH. BANTU CASE I.

Root Glands are much enlarged, moderately pigmented, and not fibrosed. They are extensively infiltrated by tumour.

Pleurae show slight increase in pigment but no plaque formation. Occasional nodules of tumour are present over both lungs.

Lungs: Sections of the lungs show very slight increase in pigment and no evidence of silicosis. There is no overt tuberculosis. In the left bronchus is tumour infiltration and there is broncho-pneumonia in the basal lobes. There is a well marked chronic bronchitis. The mediastinal glands are much enlarged and infiltrated by tumour.

Heart: is small and atrophic. The surface is studded with tumour nodules.

Microscopic sections of the left lung show the presence of a primary squamous carcinoma of bronchial origin.

Sections of the heart show metastatic foci of the same growth.

CASE II.

Underground Service: 3 years (was last underground 6 years ago).

Report on 6 specimens of sputa submitted for examination for bacillus tuberculosis. The results of the above examinations are all negative.

Report of medical examiner of the Silicosis Medical Bureau (17 days before death.)

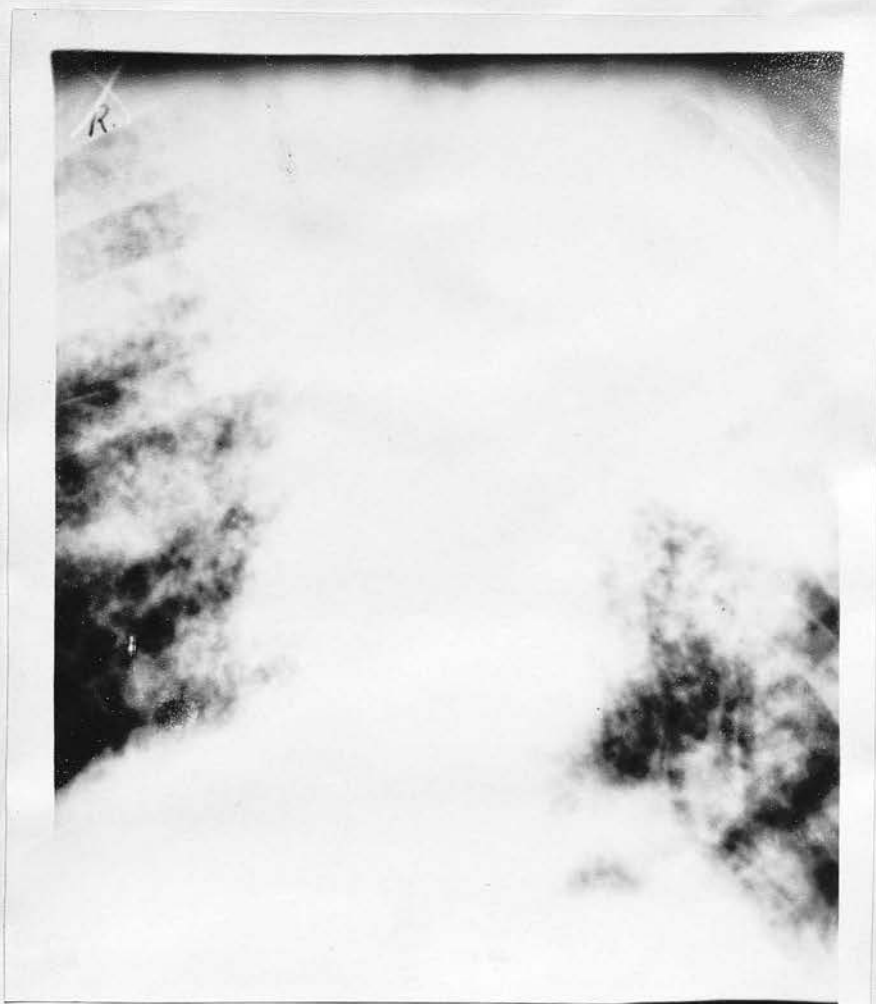
Reputed Age: ?

Present Weight (nude): 109 pounds. Has lost 34 pounds in the last 6 months.

Aspect: Sickly.

Nutrition: Poorly nourished.

Temperature: Had a temperature of 101° F. about a



RADIOGRAPH

BANTU CASE II.

month ago, but has been normal for the past 3 days.

Pulse Rate (at rest): 74

Physical signs in Lungs:

No dullness on percussion.

Auscultation: Sibilant rhonchi over both lungs. Fine crepitations are heard over the upper third of the left lung.

Radiological Report: (17 days before death). There is massive consolidation in the upper third of the left lung field and numerous small nodules scattered throughout both lung fields. There are pleuro-diaphragmatic adhesions at the left base. The radiological appearances are those of a tuberculo-silicosis with massive consolidation of the left upper lobe.

Post-Mortem Report:

Right Lung: 990 grams. Left Lung: 950 grams.

Root Glands are moderately enlarged, pigmented but are not fibrosed.

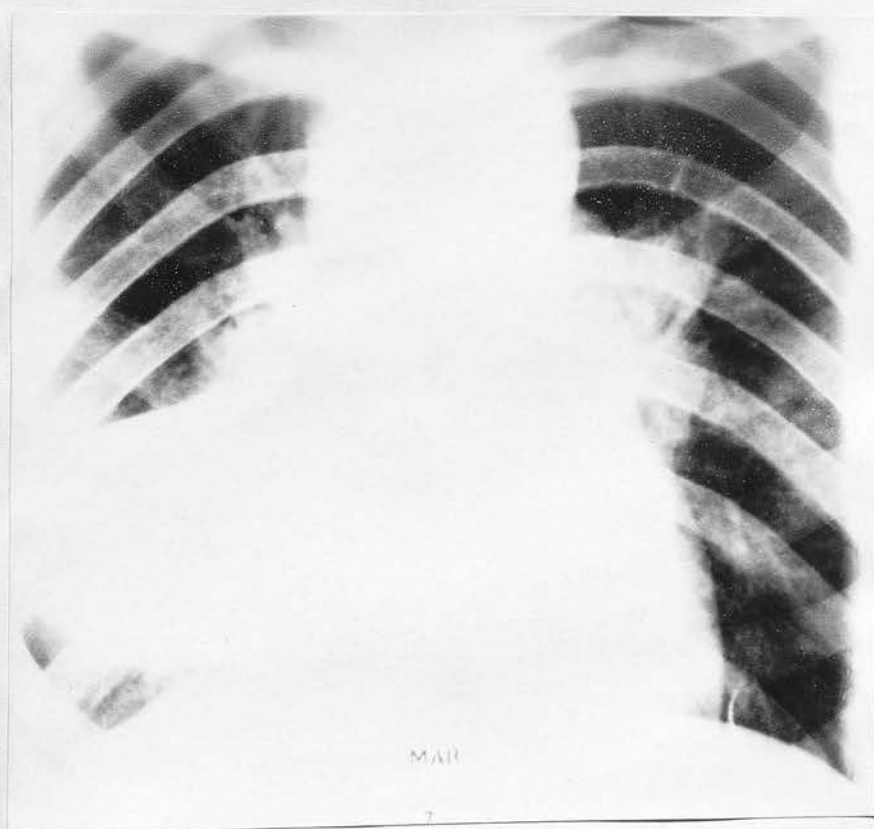
Pleurae show marked pigmentation but no plaque formation. Numerous fibrous adhesions are present on the right side and there are a few fibrous tags on the left side.

Lungs: Section of the lungs show marked pigmentation but no evidence of silicosis. There is no overt tuberculosis. Both lungs show extensive diffuse infiltration by a primary lung carcinoma originating on the left side.

Microscopic Sections show a primary bronchogenic carcinoma of the left lung and the presence of extensive infiltration of both lungs. No evidence of tuberculous infection has been observed.

CASE III.

Underground Service 2 years (Last worked underground 12 days before clinical examination).



RADIOGRAPH.

BANTU CASE III.

Report on 6 specimens of sputa submitted for examination for bacillus tuberculosis. The results of the above examinations are all negative.

Report of Medical officer of the Silicosis Medical Bureau (22 days before death).

Reputed Age: ?

Present Weight (nude). 116 pounds. Has not lost any weight for the past 6 months.

Aspect: Sickly.

Nutrition: Poorly nourished.

Physical Signs in Lungs:

Percussion: No dullness on percussion.

Auscultation: Breath sounds are reduced over the right base. Rhonchi are heard over both lungs. As the patient had ascites and two gallons of straw coloured fluid were found on tapping the abdomen a provisional diagnosis of "generalised tuberculosis" was made.

Radiological Report: (22 days before death). There is a large opacity at the basal half of the right lung field. There is no evidence of silicosis. The appearances are those of consolidation at the basal half of the right lung field and the appearances are either due to pneumonia or to a primary lung carcinoma.

Post-Mortem Report:

Right Lung: 590 grams. Left Lung: 410 grams.

Root Glands are moderately enlarged, and deeply pigmented, some are partially fibrosed.

Pleurae show moderate pigmentation with incipient plaque formation. Tags of fibrous adhesions are present.

Lungs: On section show slight to moderate pigmentation but no evidence of silicosis. There is a moderate degree of chronic bronchitis but no significant emphysema or atheroma. Consolidation is present at the base of the right lung and microscopic sections are being prepared to determine its nature.

Microscopic sections of this lung show a primary squamous carcinoma of the bronchus with lymphatic involvement and metastases in lymph nodes of the mediastinum and also in the mesenteric lymph nodes.

CASE IV.

Underground Service: 2 years.

Report on 3 specimens of sputa submitted for examination for bacillus tuberculosis. The results of the above examinations are all negative.

Report of medical examiner of the Silicosis Medical Bureau (7 days before death).

Reputed Age: ?

Present Weight: (nude) 115 pounds.

Aspect: Sickly.

Nutrition: Poorly nourished.

Physical signs in Lungs.

Percussion: Dull over the lower two-thirds of the right lung.

Auscultation: Breath sounds are reduced over the lower two-thirds of the right lung.
On tapping the right side a straw coloured effusion was obtained.

Radiological Report: (7 days before death). There is an opacity over the right lung field, extending up to the level of the first rib anteriorly. The heart, mediastinum and trachea are displaced to the opposite side. The appearances are those of a right pleural effusion but there is no definite indication of any underlying pathology.

Post-Mortem Report:

Root Glands are infiltrated by tumour.

Right Pleura is markedly thickened by a chronic pleurisy.



RADIOGRAPH.

BANTU CASE IV.

Lungs: There is no evidence of silicosis or of overt tuberculosis. The right main bronchus is infiltrated by a primary bronchogenic carcinoma.

Microscopic Sections confirm the presence of a primary bronchogenic carcinoma and there are secondaries in the liver.

CASE V.

Underground Service: 29½ years.

Reputed Age: About 60 years (examined by a private medical practitioner who removed the lungs of the deceased from the body, placed them with a preservative in a receptacle which he sealed and to which he attached an identifying label and this was then placed in a special box which was sent to the Bureau).

This case was never seen alive by the Silicosis Medical Bureau and therefore a post-mortem report only is available. This reads as follows:-

Right Lung: 690 grams. Left Lung: 580 grams.

Root glands are moderately enlarged, deeply pigmented; some show infiltration with tumour.

Pleurae show moderate pigmentation but no plaque formation. Numerous nodules of metastatic carcinoma are present over both lungs.

Lungs: Section of the lungs show moderate pigmentation but no evidence of silicosis. There is no overt tuberculosis. In the right bronchus is a carcinoma and peribronchial infiltration of the lung with carcinoma. The lungs are congested.

Microscopic Sections of specimens of lung tissue and pulmonary root glands show the presence of bronchogenic carcinoma.

CASE VI.

Never examined during life by the Bureau.

Reputed Age: (estimated by the resident physician who sent in the lungs from the non-European Hospital where the patient died) About 60 years.

Post-Mortem Report:

Right Lung: 1380 grams. Left Lung: 970 grams.

Root glands are moderately enlarged and moderately pigmented but are not fibrosed. Some on the right side are infiltrated by a malignant neoplasm.

Pleurae are markedly pigmented but show no definite plaque formation. Thin tags of fibrous adhesions are present over the left side and dense pleural thickening over the right apex.

Lungs: On section show a moderate to marked increase in pigment but no evidence of silicosis. Foci of active tuberculosis are present in both lungs.

Bronchogenic carcinoma is present in the right apical lobe in which there is also extensive necrosis and cavity formation. Both lungs show broncho-pneumonic consolidation.

Microscopic Sections show the presence of active tuberculosis and of bronchogenic squamous cell carcinoma.

Section of the root gland shows the presence of malignant neoplastic infiltration.

COMPARISON OF THE FINDINGS IN THE ABOVE MENTIONED 6
CASES OF PRIMARY LUNG CANCER WITH THE 114 EUROPEAN
CASES DESCRIBED IN THE APPENDIX.

AGE: The first difficulty that confronts a student of anthropathology is that it is usually very difficult

to estimate the age of a Bantu miner. The four cases that have been described in this Chapter were seen by four different doctors on the staff of the Silicosis Medical Bureau and none attempted to fill in the reputed age in the column provided for this purpose on the official examination form. It is generally accepted that the average Bantu does not live as long as the European but there is no statistical proof. The average Bantu miner is younger than the average European but it is important to remember that in the statistics quoted in Table 5, thousands of lungs have been sent in to the Bureau for post-mortem examination many years after the miner has left underground service. In the six cases described in this Chapter the last two cases were only seen by the Bureau long after they had left the mines and in these two cases the doctors who gave the usual death certificate and then sent in the lungs to the Bureau, estimated the ages of the Bantu miners as approximately 60 years.

TABLE 6.

AGE INCIDENCE OF PRIMARY LUNG CARCINOMA IN EUROPEAN MINERS.

In 114 Cases:-

- 1 Case (111) was aged 24 years.
- 1 Case (61) was aged 35 years.

TABLE 6 (cont.)

21 were aged from 40 to 49 years.

42 were aged from 50 to 59 years.

39 were aged from 60 to 69 years.

10 were aged from 70 to 79 years.

Simons (81) reviews the literature and in 2,796 cases found the age frequency to be as follows:-

| | | |
|-----|---------------|-----------|
| Age | 0 - 9 years | 1 Case |
| | 10 - 19 years | 6 Cases |
| | 20 - 29 years | 66 Cases |
| | 30 - 39 years | 240 Cases |
| | 40 - 49 years | 629 Cases |
| | 50 - 59 years | 945 Cases |
| | 60 - 69 years | 673 Cases |
| | 70 - 79 years | 213 Cases |
| | 80 - 89 years | 23 Cases. |

The youngest case known is that reported by Beardsley (5) of a sixteen month old child whilst the youngest case reported in a Negro is a 10 year old boy seen by Halpert and Russo (44). The oldest case reported in the literature is by Frommel (36) who had a patient 91 years old.

LUNG LOCATION. In the six Bantu cases four primary

neoplasms were found in the right lung and two in the left. In the 114 European cases, excluding two cases of endothelioma and allowing for the fact that Case 104 had a primary growth in both lungs we found that a primary neoplasm involved the right lung in 57 cases and the left in 56. In Simons' (81) collection of 2,177 cases, 1,147 had the right lung, 992 the left lung and 38 both lungs involved.

As the differences are so slight in both the above series one can say that there is no marked increase in frequency of primary lung cancer in the right lung relative to the left and there appears to be no need to stress the topographic peculiarities of the right bronchus which may result in its being more prone to the development of malignancy.

TABLE 7.

SITE OF METASTASES.

The site of the secondary deposits in the six cases in the Bantu is as follows:-

| | |
|-----------------------------------|---------|
| Root Glands | 4 Cases |
| Mediastinal and Mesenteric Glands | 2 Cases |
| Pleura | 2 Cases |
| Liver | 1 Case |
| Heart | 1 Case. |

In the 114 European cases the distribution of

metastases to individual organs is as follows:-

| | |
|-----------------|----------|
| Root Glands | 61 Cases |
| Pleura | 18 Cases |
| Liver | 16 Cases |
| Opposite Lung | 10 Cases |
| Pericardium | 6 Cases |
| Brain | 4 Cases |
| Kidneys | 3 Cases |
| Spine | 3 Cases |
| Heart | 2 Cases |
| Ribs | 2 Cases |
| Skull | 2 Cases |
| Suprarenals | 2 Cases |
| Thyroid | 1 Case |
| Cervical Glands | 1 Case |
| Pancreas | 1 Case |
| Spleen | 1 Case |
| Diaphragm | 1 Case |
| Muscle (Biceps) | 1 Case. |

There is nothing unusual about the order of frequency in these cases. The invasion of the heart, lungs, pleurae and pericardium can be regarded in most instances as being involved through direct extension. The four cases of metastases in the brain are probably due to haematogenous dissemination. It is of interest that the youngest miner (Case 111, aged 24 years) had a

miliary carcinomatosis.

WEIGHT CHARTS. In order to detect possible early cases of tuberculosis, it has been the practice of the mine hospitals to arrange that the Bantu miners be weighed every few weeks when they receive their pay. Before the period of routine x-rays, this was the method that led to the finding of numerous cases of early tuberculosis in the Bantu and the weight charts are still consulted by the mine medical officers. Just as in the case of pulmonary tuberculosis we, however, find cases that do not lose in weight. Thus, Case 3, in the Bantu did not lose any weight during the six months prior to his death but this may have partly been due to the fact that secondary involvement of the mesenteric glands led to ascites. In three European cases we find that the miner actually put on weight during the last few months before he died. Thus, Case 16 put on 5 pounds, Case 53, 3 pounds and Case 66 12 pounds. One of our thoracic surgeons finds that the prognosis in his series of cases varied with the amount of weight lost during the six month period preceding the operation.

PATHOLOGY. It is important again to mention that the European and Bantu miners have always been examined by the same pathologists at the South African Institute

for Medical Research. Thus better diagnosis cannot be said to be a reason for the higher incidence of primary lung cancer in the European.

All the 120 cases described in this book were found to be either squamous, oat-cell or adenocarcinoma, i.e. a type of bronchogenic carcinoma. Our pathologists accept the view that all these tumours arise from a parent cell in the bronchus. Recently, Graham (43) has drawn attention to another type which apparently begins in the parenchyma of the lung and probably originates in the alveolar epithelium. Graham calls this condition "Alveolar Cell Carcinoma of the Lung" and he is of the opinion that it resembles the disease found in sheep and known as "Jag-ziekte".

ENDOTHELIOMA OF THE PLEURA. There are two cases, (Nos. 5 and 93) in the European series. Our pathologists accept the view of Robertson (75) that these are not primary tumours of the pleura and that our two cases are in reality examples of a massive diffuse metastasis of a primary carcinoma of the bronchus.

DIAGNOSIS. Rienhoff (74) in 181 cases found the following symptoms:-

| | |
|-------|---------------------|
| Cough | in 71% of his cases |
|-------|---------------------|

| | |
|--------------------|---------------------|
| Haemoptysis | in 63% of his cases |
| Pain | in 50% of his cases |
| Loss of Weight | in 39% of his cases |
| Hyperpnea | in 23% of his cases |
| Pneumonitis | in 18% of his cases |
| Fever | in 13% of his cases |
| Tightness in Chest | in 3% of his cases. |

In the case of a miner most of the above symptoms are of frequent occurrence apart from malignancy. Pleurisy is common and many complain of coughing blood-streaked sputum or blood in order to obtain compensation. Whilst the Bureau physicians have an unrivalled experience of stethoscopic work, a review of the findings of physical signs in our cases shows that reliance on an early diagnosis can only be made by routine radiographic examination. Primary lung cancer is now suspected by the Bureau whenever any abnormal shadow is found which is not due to tuberculosis or tuberculo-silicosis and the case is referred for bronchoscopic examination whilst the sputum is sent to the South African Institute for Medical Research to be examined for malignant cells. In some cases "double pathology " may be suspected.

Exploratory thoracotomy is now frequently resorted to by our thoracic surgeons and amongst the miners

who recently underwent this operation and were found not to have a primary lung cancer, two cases had a tuberculoma and one a tuberculo-silicotic mass.

DEEP ROENTGEN-RAY THERAPY. Only one of our series (Case 47) had deep x-ray therapy with temporary relief. At the Johannesburg General Hospital, the radiologist L.I. Cohen (18) treated 20 cases (18 European, 2 non-European) by the extensive small-field beam-direction technique during the past 18 months. Twelve of these have died, six are alive with symptoms of the disease, whilst two are progressing satisfactorily and are at present symptom free.

LOBECTOMY AND PNEUMONECTOMY. The question of surgical treatment is quite outside the scope of this thesis and most of the successful cases have only been operated on during the last 3 years and are not included in our series, where only Case 99 had pneumonectomy but died soon after the operation.

In the last three years, D.I. Adler (1) has performed three lobectomies and eleven pneumonectomies on European miners and non-miners and the results are very encouraging.

C H A P T E R V.

RACIAL FACTOR IN THE AETIOLOGY OF THE DISEASE.

During the last few years the South African Institute for Medical Research (26) has published in its annual reports a complete analysis of pathological conditions found in both Europeans and non-Europeans and Table 8 has been compiled to include all the tumours mentioned in the 1948 and 1949 annual reports.

This tables proves that (a) malignant diseases are seen in the Bantu but occur on the whole less frequently than in the European.

(b) its localisation in different organs varies in relative frequency from that of the European. Whilst these figures cannot take the place of certified vital and mortality statistics they will serve to prove the two important points that have just been mentioned above.

The following, too, are points of interest to note in the table.

- (1). Sarcomas, keloids and fibromas are relatively common in the Bantu.
- (2). All the cases of malignant hepatoma occurred in the Bantu.
- (3). Carcinoma of the stomach is rare in the Native

almost certainly due to the differences in diet (see Chapter II).

(4). Cancer of the bladder is almost as common in the Bantu as it is in the European and is probably due to the frequent association with schistosomiasis.

(5). Carcinoma of the penis is common in the Bantu as many of them have given up the old Native ritual of circumcision.

(6). Squamous carcinoma of the cervix occurs almost as often in the Bantu as in the European owing to the frequency of lacerations.

TABLE 8 GIVING AN ANALYSIS OF PATHOLOGICAL CONDITIONS
FOUND AT THE SOUTH AFRICAN INSTITUTE FOR MEDICAL
RESEARCH.

From 1st January, 1948 to 31st December, 1949.

1. DISEASES OF THE INTEGUMENTARY SYSTEM.

| | | | <u>Euro-</u> <u>peans</u> | <u>NonEuro-</u> <u>peans.</u> |
|----------------------------|-----|-----|------------------------------|----------------------------------|
| Squamous papilloma... | ... | ... | 211 | 50 |
| Precancerous changes | ... | ... | 22 | 3 |
| Squamous carcinoma... | ... | ... | 134 | 71 |
| Basal celled carcinoma | ... | ... | 153 | 14 |
| Malignant melanoma... | ... | ... | 50 | 30 |
| Spindle cell sarcoma | ... | ... | 16 | 30 |
| Reticulum cell sarcoma | ... | ... | 2 | 1 |
| Calcifying epithelioma | ... | ... | 2 | 0 |
| Kaposi's angiosarcoma | ... | ... | 3 | 24 |
| Recurrent cellular fibroma | ... | ... | 5 | 10 |
| Desmoid. | ... | ... | 3 | 5 |
| Myxofibroma | ... | ... | 2 | 0 |

TABLE 8 (Cont.)

| | | | | <u>Euro-</u> <u>peans</u> | <u>nonEuro-</u> <u>peans.</u> |
|------------------------------|-----|-----|-----|------------------------------|----------------------------------|
| Glomangioma... | ... | ... | ... | 2 | 1 |
| Keloid | ... | ... | ... | 3 | 21 |
| Fibroma | ... | ... | ... | 35 | 28 |
| Xanthofibroma | ... | ... | ... | 33 | 13 |
| Haemangioma and Lymphangioma | ... | ... | ... | 78 | 43 |
| Lipoma | ... | ... | ... | 86 | 37 |
| Endothelioma | ... | ... | ... | 3 | 3 |
| Syringocystoma | ... | ... | ... | 4 | 3 |
| Histiocytoma | ... | ... | ... | 2 | 0 |

B. Mammae

| | | | | | |
|--|-----|-----|-----|-----|----|
| Spheroidal cell carcinoma | ... | ... | ... | 263 | 38 |
| Adenocarcinoma | ... | ... | ... | 69 | 19 |
| Paget's disease of the nipple... | ... | ... | ... | 5 | 0 |
| Lipoma | ... | ... | ... | 3 | 0 |
| Fibroadenoma | ... | ... | ... | 124 | 28 |
| Fibroadenosis and fibroepitheliosis | ... | ... | ... | 258 | 7 |
| Intraduct papilloma | ... | ... | ... | 38 | 1 |

2. DISEASES OF THE MUSCULO-SKELETAL SYSTEM.A. Bones

| | | | | | |
|--------------------------|-----|-----|-----|----|----|
| Osteoclastoma | ... | ... | ... | 10 | 3 |
| Malignant osteoclastoma | ... | ... | ... | 1 | 0 |
| Osteochondroma | ... | ... | ... | 12 | 4 |
| Myxochondroma | ... | ... | ... | 3 | 1 |
| Myxosarcoma | ... | ... | ... | 1 | 1 |
| Round cell sarcoma | ... | ... | ... | 1 | 1 |
| Spindle celled sarcoma | ... | ... | ... | 2 | 0 |
| Periosteal sarcoma | ... | ... | ... | 3 | 3 |
| Osteogenic sarcoma | ... | ... | ... | 8 | 10 |
| Osteoma | ... | ... | ... | 6 | 6 |
| Myeloma | ... | ... | ... | 2 | 8 |
| Mixed odontogenic tumour | ... | ... | ... | 1 | 1 |
| Adamantinoma.. | ... | ... | ... | 5 | 9 |

B. Joints and Tendons.

| | | | | | | |
|--|-----|-----|-----|-----|----|---|
| Benign giant cell tumour of tendon sheath | ... | ... | ... | ... | 15 | 3 |
|--|-----|-----|-----|-----|----|---|

TABLE 8 (Cont.)

| | | | | <u>Euro-</u> <u>peans</u> | <u>nonEuro-</u> <u>peans.</u> |
|-------------------|-----|-----|-----|------------------------------|----------------------------------|
| Angioendothelioma | ... | ... | ... | 0 | 2 |
| Synovioma.... | ... | ... | ... | 4 | 3 |
| Fibrosarcoma, | ... | ... | ... | 1 | 1 |

C. Fascia.

| | | | | | |
|-------------|-----|-----|-----|---|---|
| Sarcoma ... | ... | ... | ... | 8 | 7 |
|-------------|-----|-----|-----|---|---|

3. RESPIRATORY SYSTEM.A. Trachea.

| | | | | |
|-----------------------|-----|-----|---|---|
| Squamous carcinoma... | ... | ... | 2 | 0 |
|-----------------------|-----|-----|---|---|

B. Bronchi.

| | | | | |
|------------------------|-----|-----|----|---|
| Adenoma | ... | ... | 6 | 0 |
| Bronchogenic carcinoma | ... | ... | 21 | 5 |

C. Nose.

| | | | | |
|--------------------------------------|-----|-----|---|---|
| Reticulum cell sarcoma | ... | ... | 0 | 2 |
| Squamous carcinoma... | ... | ... | 5 | 1 |
| Schneiderian carcinoma | ... | ... | 2 | 0 |
| Anaplastic spheroidal cell carcinoma | | | 4 | 0 |

D. Accessory Sinuses.

| | | |
|---------------------------------------|---|---|
| Squamous carcinoma (Maxillary antrum) | 1 | 8 |
|---------------------------------------|---|---|

E. Larynx.

| | | | | |
|-----------------------|-----|-----|----|----|
| Squamous papilloma... | ... | ... | 39 | 16 |
| Squamous carcinoma... | ... | ... | 16 | 2 |

4. DISEASES OF THE CARDIO-VASCULAR SYSTEM.

| | | | | |
|------------------|-----|-----|---|---|
| Rhabdomyosarcoma | ... | ... | 1 | 0 |
|------------------|-----|-----|---|---|

TABLE 8 (Cont.)

| | | | | | <u>Euro-</u> <u>peans</u> | <u>nonEuro-</u> <u>peans.</u> |
|------------------|-----------------|-----|-----|-----|------------------------------|----------------------------------|
| B. | <u>Vessels.</u> | | | | | |
| Hygroma ... | ... | ... | ... | ... | 1 | 0 |
| Angiosarcoma ... | ... | ... | ... | ... | 0 | 1 |

5. DISEASES OF THE HAEMIC AND LYMPHATIC SYSTEMS.

A. Blood.

| | | | | | | |
|------------------------|-----|-----|--|--|---|---|
| Myelogenous Leukaemia. | ... | ... | | | 0 | 8 |
|------------------------|-----|-----|--|--|---|---|

B. Spleen.

| | | | | | | |
|-------------------|-----|-----|-----|-----|---|---|
| Lymphosarcoma ... | ... | ... | ... | ... | 0 | 1 |
|-------------------|-----|-----|-----|-----|---|---|

C. Lymph Nodes.

| | | | | | | |
|---------------------------------|-----|-----|-----|-----|----|----|
| Lymphosarcoma ... | ... | ... | ... | ... | 17 | 13 |
| Reticulum cell sarcoma | ... | ... | ... | ... | 34 | 35 |
| Giant follicular lymphoblastoma | ... | ... | ... | ... | 10 | 0 |
| Lymphatic leukaemia ... | ... | ... | ... | ... | 5 | 1 |
| Malignant lymphoma ... | ... | ... | ... | ... | 3 | 2 |

6. DISEASES OF THE DIGESTIVE SYSTEM.

A. Mouth.

| | | | | | | |
|-------------------------|-----|-----|-----|-----|----|----|
| Squamous papilloma ... | ... | ... | ... | ... | 21 | 6 |
| Squamous carcinoma ... | ... | ... | ... | ... | 40 | 39 |
| Precancerous lesions... | ... | ... | ... | ... | 2 | 0 |
| Fibrosarcoma ... | ... | ... | ... | ... | 1 | 0 |
| Angioma ... | ... | ... | ... | ... | 2 | 2 |

B. Salivary Glands.

| | | | | | | |
|--------------------------|-----|-----|-----|-----|----|----|
| Mixed tumours ... | ... | ... | ... | ... | 43 | 66 |
| Adenolymphoma ... | ... | ... | ... | ... | 3 | 0 |
| Adenoma ... | ... | ... | ... | ... | 2 | 0 |
| Cystadenomalymphomatosum | ... | ... | ... | ... | 2 | 0 |
| Adenocarcinoma... | ... | ... | ... | ... | 1 | 0 |



TABLE 8 (Cont.)

| | <u>Euro-</u> <u>peans.</u> | <u>nonEuro-</u> <u>peans.</u> |
|---|-------------------------------|----------------------------------|
| C. <u>Pharynx and Oesophagus.</u> | | |
| Reticulum cell sarcoma (tonsil or pharynx) ... | 2 | 1 |
| Squamous carcinoma (oesophagus) | 15 | 11 |
| Squamous papilloma ... | 4 | 0 |
| Squamous carcinoma (pharynx) | 14 | 4 |
| D. <u>Stomach.</u> | | |
| Adenocarcinoma ... | 59 | 8 |
| Spheroidal cell carcinoma ... | 15 | 3 |
| Leiomyosarcoma ... | 2 | 1 |
| Lymphosarcoma ... | 1 | 0 |
| Leiomyoma... | 4 | 1 |
| E. <u>Small Intestine.</u> | | |
| Adenomatous polyp ... | 2 | 0 |
| Leiomyoma... | 2 | 2 |
| Leiomyosarcoma ... | 2 | 0 |
| Carcinoid .. | 1 | 1 |
| F. <u>Large Intestine and Appendix.</u> | | |
| Adenocarcinoma (colon and rectum) | 121 | 11 |
| Spheroidal cell carcinoma (colon) | 3 | 0 |
| Reticulum cell sarcoma,... | 1 | 0 |
| Lymphosarcoma ... | 0 | 2 |
| Carcinoids ... | 4 | 1 |
| G. <u>Anus.</u> | | |
| Squamous carcinoma ... | 2 | 0 |
| H. <u>Liver. and Biliary Tract.</u> | | |
| Malignant hepatoma ... | 0 | 76 |
| Squamous carcinoma (Gall bladder) | 7 | 0 |
| I. <u>Mesentery and Peritoneum.</u> | | |
| Sarcoma ... | 1 | 3 |

TABLE 8 (Cont.)

| | <u>Euro-</u> <u>peans</u> | <u>nonEuro-</u> <u>peans.</u> |
|--|------------------------------|----------------------------------|
| <u>J. Pancreas.</u> | | |
| Adenoma | 0 | 1 |
| Adenocarcinoma... | 3 | 4 |
| Nesidioblastoma.. | 2 | 1 |
| 7. <u>DISEASES OF THE UROGENITAL SYSTEM.</u> | | |
| <u>A. Kidney and Pelvis.</u> | | |
| Transitional cell papilloma .. | 1 | 0 |
| Transitional cell carcinoma... | 2 | 0 |
| Nephroblastoma | 7 | 3 |
| Adenocarcinoma | 12 | 9 |
| Adenoma | 1 | 4 |
| <u>B. Bladder.</u> | | |
| Leiomyoma | 0 | 1 |
| Carcinoma | 20 | 15 |
| <u>C. Ureter.</u> | | |
| Papilloma | 2 | 0 |
| Carcinoma | 9 | 3 |
| <u>D. Urethra.</u> | | |
| Carcinoma | 3 | 0 |
| <u>E. External Male Organs.</u> | | |
| <u>Penis</u> | | |
| Squamous carcinoma.. ... | 0 | 5 |
| <u>Testis and Epididymis.</u> | | |
| Seminoma | 7 | 1 |
| Embryonal adenocarcinoma | 3 | 2 |
| Fibroma (epididymis) ... | 2 | 0 |
| Teratoma (Benign)... .. | 1 | 0 |
| Teratoma (Malignant) ... | 3 | 0 |
| Sarcoma (tunica vaginalis) | 1 | 0 |

TABLE 8 (Cont.)

| | | | | <u>Euro-</u> <u>peans</u> | <u>nonEuro-</u> <u>peans.</u> |
|-----------------------------------|-----|-----|-----|------------------------------|----------------------------------|
| Spermatic Cord. | | | | | |
| Fibrolipoma | ... | ... | ... | 0 | 1 |
| F. <u>Internal Male Organs.</u> | | | | | |
| Prostate. | | | | | |
| Adenocarcinoma | ... | ... | | 48 | 6 |
| G. <u>External Female Organs.</u> | | | | | |
| Labia | | | | | |
| Squamous papilloma | ... | ... | | 2 | 5 |
| Fibroma | ... | ... | ... | 1 | 2 |
| Rhabdomyosarcoma | ... | ... | | 1 | 0 |
| Squamous carcinoma | ... | ... | | 8 | 9 |
| Malignant melanoma (clitoris) | | | | 1 | 0 |
| H. <u>Internal Female Organs.</u> | | | | | |
| Vagina. | | | | | |
| Squamous papilloma | ... | ... | | 6 | 9 |
| Squamous carcinoma | ... | ... | | 12 | 15 |
| Spheroidal celled carcinoma | | | | 4 | 1 |
| Adenocarcinoma | ... | ... | | 1 | 2 |
| Cervix. | | | | | |
| Squamous carcinoma | ... | ... | | 216 | 170 |
| Spheroidal cell carcinoma | ... | | | 2 | 2 |
| Adenocarcinoma | ... | ... | | 5 | 6 |
| Fibromyoma | ... | ... | ... | 3 | 2 |
| Sarcoma | ... | ... | ... | 0 | 1 |
| Sarcoma botryoides | ... | ... | | 1 | 0 |
| Endometrium. | | | | | |
| Adenomatous hyperplasia | ... | | | 104 | 10 |
| Simple polyp | ... | ... | ... | 155 | 20 |
| Adenocarcinoma | ... | ... | ... | 83 | 8 |
| Squamous carcinoma | ... | ... | | 2 | 2 |
| Spheroidal cell carcinoma | | | | 6 | 0 |
| Myometrium. | | | | | |
| Fibromyoma | ... | ... | ... | 177 | 66 |
| Adenomyosis | ... | ... | ... | 33 | 5 |
| Sarcoma | ... | ... | ... | 12 | 5 |

TABLE 8 (Cont.)

| | <u>Euro-</u> <u>peans.</u> | <u>nonEuro-</u> <u>peans.</u> |
|----------------------------------|-------------------------------|----------------------------------|
| Ovary. | | |
| Fibroma | 14 | 4 |
| Dermoid ... | 19 | 2 |
| Pseudomucinous cystadenoma . | 25 | 3 |
| Papilliferous serous cystadenoma | 17 | 3 |
| Adenocarcinoma... | 57 | 6 |
| Spheroidal cell carcinoma... | 3 | 3 |
| Granulosa cell neoplasm ... | 2 | 2 |
| Brenner neoplasm ... | 0 | 1 |
| Dysgerminoma ... | 1 | 0 |
| Teratoma... | 0 | 1 |
| Fibrosarcoma ... | 0 | 2 |

I. Female Genital Organs During Pregnancy.

| | | |
|---------------------------|---|---|
| Chorionepithelioma | 2 | 3 |
|---------------------------|---|---|

8. DISEASES OF THE ENDOCRINE SYSTEM.A. Thyroid.

| | | |
|---------------------------------------|-----|----|
| Colloid goitre and/or colloid adenoma | 121 | 47 |
| Papillary adenoma ... | 13 | 5 |
| Hürthle cell tumour . | 2 | 0 |
| Adenocarcinoma ... | 7 | 9 |

B. Pituitary.

| | | |
|-------------------------|---|---|
| Chromophobe adenoma ... | 0 | 2 |
|-------------------------|---|---|

C. Suprarenal.

| | | |
|----------------------|---|---|
| Cortical adenoma ... | 1 | 1 |
|----------------------|---|---|

9. DISEASES OF THE NERVOUS SYSTEM.A. Meninges.

| | | |
|----------------|---|---|
| Meningioma ... | 4 | 7 |
|----------------|---|---|

B. Brain.

| | | |
|-----------------------|---|---|
| Craniopharyngioma ... | 0 | 2 |
|-----------------------|---|---|

TABLE 8 (Cont.)

| | | | | <u>Euro-</u> <u>peans</u> | <u>nonEuro-</u> <u>peans.</u> |
|----------------------------|-----|-----|-----|------------------------------|----------------------------------|
| Astrocytoma... | ... | ... | ... | 1 | 1 |
| Spongioblastoma multiforme | | | ... | 2 | 3 |
| Medulloblastoma | ... | ... | ... | 2 | 1 |

C. Peripheral Nerves.

| | | | | | |
|-----------------|-----|-----|-----|----|----|
| Neurofibroma... | ... | ... | ... | 42 | 36 |
| Neurosarcoma... | ... | ... | ... | 9 | 5 |

D. Sympathetic System.

| | | | | | |
|----------------|-----|-----|-----|---|---|
| Ganglioneuroma | ... | ... | ... | 1 | 1 |
| Neuroblastoma | ... | ... | ... | 4 | 1 |

10. DISEASES OF ORGANS OF SPECIAL SENSE.A. Eye.

| | | | | | |
|------------------------|-----|-----|-----|---|---|
| Staphyloma | ... | ... | ... | 2 | 3 |
| Haemangioma of Choroid | ... | ... | ... | 1 | 1 |
| Melanoma | ... | ... | ... | 7 | 3 |
| Squamous carcinoma | ... | ... | ... | 2 | 2 |
| Fibrosarcoma | ... | ... | ... | 1 | 0 |
| Optic nerve meningioma | ... | ... | ... | 1 | 0 |
| Retinal Glioma | ... | ... | ... | 1 | 6 |

FREQUENCY OF PRIMARY CARCINOMA OF THE LIVER.

J.H. Lewis (56) claims that there is no illness which affects one race that may not also affect every other race, although the manifestations of an illness may vary widely amongst races both quantitatively and qualitatively. Berman (8) in his thesis on "Primary Carcinoma of the Liver" claims that it is a disease which is controlled by racial and not by environmental

factors and he quotes statistics to show that the distribution depends solely upon the racial distribution of mankind. J. Gillman (38) points out the relation of the high frequency of primary carcinoma of the liver to the number of multinucleated cells in the liver of normal Bantus. Whilst about 5 per cent of the liver cells are binucleated in the European from 10 to 34 per cent of the liver cells show this condition in the Bantu. This theory is, however, largely discounted by the fact that many other Bantu organs show evidence of multinucleation of the cells.

Most writers to-day tend to agree with Berman that the high incidence of primary liver cancer is not due to any great extent to an extrinsic factor. Pirie (70), however, many years ago, drew attention to the occurrence of hepatic carcinoma in Natives and its frequent association with schistosomiasis and that a feature of nearly every one of his cases of primary carcinoma of the liver was the concomitant presence of cirrhosis. In the Bantu, alcohol has to be considered amongst the extrinsic causes of cirrhosis leading to primary carcinoma. Berman (8) found that in nearly 99 per cent of his cases cirrhosis of the liver preceded the formation of a malignant hepatoma and agrees that if alcohol is accepted as a cirrhotic agent then the fibrotic

changes in the liver may be due to alcohol as all the Bantu races are accustomed to the consumption of alcoholic beverages from early childhood.

Davies (22) and Vint (93) found that cirrhosis was very common in all African races and they thought it was the result of malnutrition. Davies puts forward the theory that the malnutrition in childhood leads to liver damage so that it is unable to inactivate oestrogens and he suggests that this sex hormone upset is an important aetiological factor.

Gillman, Gilbert and Gillman (39) found that chronic malnutrition causes an accumulation of lymphocytes in the liver, salivary glands and other organs and after a period of many years there is a stage where the lymphocytes are replaced by collagen fibres. Berman (8), however, found a high incidence of cirrhosis and malignant hepatoma in the Bantu miner, who does not suffer from malnutrition, so that it is doubtful if the fibrous tissue reaction is a special manifestation of a malnutritional syndrome. In the Bantu, whether he is a miner or not, there is a definite tendency to increased fibrous tissue formation and in the miner it is not due to malnutrition (see Chapter II). It is suggested that some "accelerating factor" may be present in the connective tissues of the Bantu which causes this tendency to increased fibrous tissue

formation.

A FEW ANATOMICAL AND PHYSIOLOGICAL DIFFERENCES BETWEEN
THE EUROPEAN AND BANTU.

R. Elsdon Dew (29) in his thesis on "Blood Groups of the Bantu in Southern Africa" claims that from the serological point of view the Bantus are the most primitive black races known, The original black probably only had group "O" blood and to-day the blood of the Bantu is the result of interaction between the Caucasoid race and a primitive black race showing very little or no "A" and "B". The author contends that the black race originally had no agglutinogens.

Barnes and Gordon (4) have shown that the Southern Bantu differs in gastric chemistry from the European as well as from the Nigerian Native. J.F. Maingard (64) has studied the anatomy of the parathyroid glands and claims that the different location of the parathyroids in the Bantu as compared to that in the European is of surgical importance.

In the lungs, however, no difference has been detected between the European and the Bantu. In the numerous lungs that have been examined post-mortem there has been no difference in the anatomy or histology.

PRIMARY CARCINOMA IN THE BANTU.

The following table has been compiled from various authors and shows the number of cases of malignant disease amongst the Bantu, as recorded in the South African Medical literature during the last 30 years. It is of interest to note that H.L. Heiman (46) records the incidence of malignant disease amongst the Europeans as 3.97 per cent of the total admissions to the Johannesburg European Hospital as compared to .9 per cent at the non-European Hospital.

TABLE 9 SHOWING THE NUMBER OF CASES OF PRIMARY CARCINOMA IN THE BANTU AS REPORTED IN THE SOUTH AFRICAN MEDICAL LITERATURE.

| | <u>Cases of Carcinoma.</u> |
|--|--------------------------------|
| PIRIE.(70) (1921) From Pathological Material sent to South African Institute for Medical Research (1912-1921) | 93. |
| MACFARLANE.(60) (1924). Bantus from Basutoland. | 36. |
| MAC VICAR.(62 and 63) (1925). Victoria Hospital, Lovedale (to 1935) | 147. |
| WATKINS-PITCHFORD.(97) (1906-1909) Bantu Population of Natal and Zululand | 17. |
| DESLIGNERIS.(24) (1927) Northern Transvaal | 6. |
| BEYERS.(9) (1921-1926) Johannesburg (non-European Hospital) | 75. |
| ORENSTEIN. (66) (1927) Mine Hospitals | 37 |

TABLE 9 (Cont.)

| | <u>Cases of Carcinoma.</u> |
|---|--------------------------------|
| FISCHER (32 and 33) (1932) City Deep Hospital. | 19. |
| STRACHAN (86) (1934) Johannesburg | 73 |
| BERMAN (8) Johannesburg Hospital (1926-1933) | 215 |
| BERMAN (8) Mine Hospitals (1925-1933) | 253. |

Similarly in other parts of Africa fairly large numbers of malignant tumours have been seen by pathologists. Thus, Vint (93) in Kenya reported on 455 cases (277 carcinoma and 178 sarcoma), Smith and Elmes (82) classifying 500 tumour specimens collected over 8 years from Natives at Lagos, Nigeria, found 225 cases of carcinoma and 180 sarcomas whilst J.N.P. Davies (21) had 85 cases of carcinoma from 1931 to 1947 and of these, two were cases of bronchial neoplasm out of a total of 2,162 post-mortems performed at the Mulago hospital from 1931 to 1947.

CANCER STATISTICS FOR EUROPEANS IN SOUTH AFRICA.

Successive annual reports of the Department of Public Health have drawn attention to the high and steadily increasing death rate from Cancer.

The cancer death rate amongst Europeans was as follows:-

TABLE 10 SHOWING DEATH RATE FROM CANCER OF ALL TYPES
IN THE EUROPEAN POPULATION OF THE UNION OF SOUTH
AFRICA.

| | |
|------|---------------------|
| 1920 | 58 per 100,000 |
| 1930 | 82.62 per 100,000 |
| 1940 | 102.8 per 100,000 |
| 1944 | 111.96 per 100,000 |
| 1945 | 112.59 per 100,000. |

INCREASE IN CASES OF PRIMARY LUNG CANCER. There are many publications which contain statistics to show that the number of cases of primary carcinoma of the lung is on the increase. It is still being debated as to whether the increase is absolute or merely relative. Hoffman (47) in 1914 recorded a rate of .6 per 100,000 population. Ten years later the number had increased to 1.6 per 100,000 population. In England and Wales the statistics (71) show that the total deaths from cancer of the lung and pleura had increased rapidly during the last 50 years. The figures are as follows:-

| | | |
|-------|------|-------------|
| Years | 1899 | 231 Cases |
| | 1909 | 383 cases |
| | 1919 | 430 cases |
| | 1929 | 1208 cases |
| | 1939 | 4540 cases |
| | 1947 | 9287 cases. |

Statistics (84) compiled by the American Cancer Society show a great increase in the incidence of bronchogenic cancer and Heady and Kennaway (45) have recently discussed the evidence of an increase in England and Wales. In South Africa too, there is an increase in the number of cases amongst Europeans but the pathologists cannot come to any unanimous decision as to whether the increase is apparent or real.

MALIGNANT DISEASE IN PIGMENTED RACES (per 100,000 of Population).

Hoffman (47), an authority on statistics in cancer quotes the following figures to show the incidence of malignant disease in pigmented races.

TABLE 11 SHOWING THE INCIDENCE OF MALIGNANT DISEASE IN PIGMENTED RACES PER 100,000 OF POPULATION.

| | |
|----------------------|------|
| American(Negro) | 86.8 |
| Japan | 76.1 |
| Canada (Indian) | 70.6 |
| Algeria | 70 |
| Hawaii | 68.5 |
| Mexico | 62.4 |
| America (Indian) | 50 |
| Nyasaland | 41 |
| Manila | 40.3 |
| Straits Settlements | 30 |
| New Zealand (Maoris) | 26 |

| | |
|----------------------|------|
| India | 20 |
| South Africa (Bantu) | 18.8 |
| Ceylon | 9.9 |

The Statistical Research Division of the American Cancer Society (84) quote the following figures for the United States in 1948,

"Lung and Bronchus Deaths. Death Rate (All Ages)

| | |
|-----------|--------|
| White | 18.6 |
| Non-White | 10.4 " |

The South African Bantu is second lowest in this list whilst the cancer mortality of the American Negro population tends more and more to approach the corresponding rate in the European. It is to be noted that the South African Bantu is regarded as one who has not inter-married with the white for if there is the slightest doubt as to the racial origin then it is usual to classify them as "Coloured or Eurafrican" (See Table 1.) On the other hand the American Negro has mated with the whites from the time of his first appearance in America. Lewis (56) writes as follows:-

"the white element in the Negro population is increasing and it is due to continued miscegenation with whites and mostly to the union of blacks with mulattoes (equal parts of white and black) and mulattoes with mulattoes."

CANCER IN URBAN NATIVES. During the period 1926 to 1936 the writer was "Senior Medical Officer of the

Northern Free State General Hospital" which has 200 beds and caters for both the Europeans and the non-Europeans in Kroonstad and in the surrounding districts which form an area of about 10,000 square miles.

Careful records showed that there was a difference in the incidence of cancer between the primitive Bantu who lived on the farm and in the Native reserves (these Natives receive excellent medical service from the district surgeons who visited them free of charge and if necessary send them in to hospital) and those who lived in the towns where they adopted European habits of living and eating. Despite this finding there was still a tremendous difference in the incidence of cancer among the Bantu as compared to the European and this can only be explained by accepting a racial origin as an important factor in the aetiology of the disease.

VIEW THAT RACE PLAYS NO PART IN THE AETIOLOGY OF CANCER

On the other hand there are some authors who claim that race plays no part in the cancer rate. Amongst the best known supporters of this view is E.B. Vedder (91) who investigated the position in the Philippines. His view is that the real cancer rate for the Filipinos is not any lower than the cancer rate in the registration area of the United States and he thinks that the assumption that cancer is pre-

eminently a disease of civilisation is untenable.

Apart from the statistics given in Table 11 it is later proposed to show that in Johannesburg, the largest town of South Africa, the question of race can under no circumstances be excluded amongst the factors that cause the large difference in the incidence of carcinoma.

VIEW THAT CANCER OCCURS VERY RARELY IN NON-EUROPEAN

RACES. The statistics already quoted show that cancer occurs in practically all non-European countries, but there are still some writers who claim that they have not seen any cases and especially that they have not come across a single case of primary lung cancer. Thus, A.F. Ludlow (58) in a study of carcinoma in Korea was unable to find one case whilst J.B. Cleland (17) who investigated various malignant and other diseases amongst the Australian aborigines notes that carcinoma is probably a rare condition and that he had not yet seen a single case of primary lung carcinoma. Dupont (28) in 1942 wrote a very interesting article on the absence of cancer in Tchad.

CANCER IN OTHER NON-EUROPEAN RACES.

Just as we have found that carcinoma occurs less commonly in coloured races so does a review of the literature suggest that primary carcinoma of the lung

is less common amongst the coloured races. F.L. Hoffman (47 and 48) found that in New Orleans the rate was 2.8 per 100,000 for the white population and .6 per 100,000 for the coloured. C. Bonne (10) in Java and Sumatra found four cases of primary lung cancer in Malays in 3,885 autopsies whilst in 2,015 autopsies in Chinese he too found four cases of primary lung cancer. In Egypt out of 500 cases of carcinoma, Hoffman (49) could only find 2 cases of primary lung neoplasm.

RACE AS AN IMPORTANT AETIOLOGICAL FACTOR IN THE PRODUCTION OF PRIMARY LUNG CANCER.

Whilst no vital statistics exist for the Bantu races for the whole of the Union of South Africa, it has been found possible to obtain accurate statistics for Johannesburg, a compact industrial and mining town where every death is registered by the "Public Health Department of the Municipality" and the non-European population is under the care of district surgeons, municipal medical officers in the locations (reserved for Natives) and the mine medical officers. The following table (50) gives the latest figures of the number of deaths registered in Johannesburg for a period of one year, and the number of cases of primary lung cancer in the Europeans and in the Bantu.

TABLE 12 SHOWING THE NUMBER OF DEATHS IN THE JOHANNESBURG MUNICIPALITY AREA DURING THE PERIOD JULY 1st 1949 to JUNE 30th, 1950.

| | Popula- tion of Johannes- burg. | Total Number of Deaths from all Causes | Total Cancer Deaths | Number of Deaths from Primary Broncho- genic Carcinoma |
|---|--|---|---------------------------|--|
| Europeans (Miners and Non miners) | 349,900 | 2,836 | 403 | 54 |
| Bantu (Miners and Non miners) | 470,700 | 5,252 | 113 | 8 |

Just as we have found in South Africa that "Poliomyelitis" rarely affects the Bantu, the statistics already quoted indicate that "Primary Carcinoma of the Lung" and many other malignant conditions occur less frequently in the Bantu. In the latest figures for Johannesburg we have found that primary lung neoplasm occurs about ten times more frequently in the white race.

Whilst we have yet to consider a number of extrinsic factors in the aetiology of the disease one can confidently claim that in the Bantu there is probably an intrinsic or genetic racial factor which in the case of the lung renders that organ less suscep-

tible to the production of a neoplasm. Whilst no one has yet been able to indicate the nature of this racial difference a number of findings suggest that it may be due to some factor associated with the connective tissue.

FIBROUS TISSUE THEORY OF RACE SUSCEPTIBILITY.

Before suggesting this theory we must quote Retief (72 and 73) who finds that the average length of service of Natives before they are certified as having silicosis is 9 years as compared to an average of 21 years in Europeans. In this Chapter we have seen that

- (1) carcinomas and sarcomas of all types occur in the Bantu.
- (2) that in most organs there is a definite difference between the incidence rate in Europeans and the Bantu.
- (3) that in Johannesburg the death rate from primary cancer of the lung is 10 times greater in the European than in the Bantu.
- (4) the reports of the South African Institute for Medical Research show that keloids, sarcomas, fibroids, fibromas and cirrhosis leading to malignant hepatomas are more common in the Bantu.
- (5) the fact that the Bantu gets silicosis in less than half the time taken by the European suggests

that his lung is more prone to the formation of fibrous tissue.

The Native does not work under exactly the same conditions as the European but if all factors such as intermittent service, infection and statistics are taken into account the opinion of the Bureau is still that he will get fibrosis of the lungs in a much shorter time than will the European.

Whilst there is no anatomical or histological evidence in the lung to suggest that there is more connective tissue stroma supporting the epithelial elements it is possible that the connective tissue stroma in the Bantu shows a greater tendency to proliferate so that (a) any abnormal epithelial cells during the process of growth are killed before they have time to develop into a small tumour, just as probably certain tumour cells are destroyed therapeutically by x-rays with its attendant fibrosis and (b) this accelerating factor in the connective tissue may be the cause of the relatively frequent occurrence of keloids, sarcomas, fibromas, cirrhosis leading to malignant hepatomas, and would be one of the explanations as to why non-Europeans get silicosis in less than half the time taken by the European.

Even if one day a virus or some other factor may be found to be the cause of cancer, this theory or

some other explanation will have to be found to reflect the real biological differentiation between the Bantu and the European, and enable us to give the reason why there is such a great difference in the incidence of primary lung cancer between the two races.

HEREDITY.

Simons (81) in his book quotes 930 cases of primary bronchogenic carcinoma where 64 were said to have a positive hereditary strain but one has found it quite impossible to obtain information from a Bantu miner as to the nature of the diseases from which his parents or relatives had died.

CHAPTER VI.

EXTRINSIC FACTORS IN THE CAUSATION OF THE DISEASE.

M. Davidson (20) in 1930 commenced his chapter on the aetiology of primary lung cancer by saying that it has been the subject of much speculative investigation in the last few years and that it has now become a most urgent and most difficult matter.

The Bantu miner is especially affected by tuberculosis, pneumonia and trauma and his environment and smoking habits are quite different from that of the European.

It is proposed to discuss the various possible extrinsic factors under five main headings.

- (a). Tobacco Smoking.
- (b). Trauma.
- (c). Influenza and Pneumonia.
- (d). Tuberculosis.
- (e). Silicosis, dust, nitrous fumes and radioactive substances.

C H A P T E R VI (a)TOBACCO AND PRIMARY CANCER OF THE LUNG.

For the past 40 years numerous writers have regarded tobacco smoking as an important aetiological factor in the causation of carcinoma of the lung. Adler (2) was one of the first to note that male cases exceeded female and he attributed the difference to irritation caused by the smoking of tobacco. Later F.E. Tylecote (90) suggested that smoking may be an aetiological factor. E. Graham (42) in his book mentions that Hoffman was unable to find a single case which could be attributed to nicotine but at the recent "International Cancer Congress" held in Paris, E.L. Wynder and E.A. Graham (102) brought forward evidence which shows that there is a close relationship between the incidence of primary carcinoma of the lung and the amount of tobacco taken by various groups. They felt that the time had now arrived to identify and eliminate possible carcinogens in tobacco.

The large scale investigations carried out recently in the United States of America have been fully described by Wynder and Graham (101). Out of 684 cases of bronchogenic carcinoma 634 were personally interviewed and a detailed history was taken to enable the team of interviewers to classify them as

non smokers, light, moderate and heavy and chain smokers. Other patients of the same age and economic groups were used as controls. Their main findings may be summarised as follows:-

- (1) Excessive and prolonged use of tobacco (especially in the form of cigarettes) seems to be an important factor in the induction of bronchogenic carcinoma.
- (2) Amongst 605 men with bronchogenic carcinoma, other than adenocarcinoma, 96.5 per cent were moderately heavy or chain smokers for many years compared with 73.7 per cent among the general population without cancer.
- (3) It is rare to find a case of epidermoid and undifferentiated carcinoma in a male patient who has not been at least a moderately heavy smoker for many years.
- (4) The use of cigarettes is much greater among patients with cancer of the lung than among other patients of the same age and economic groups.
- (5) Of the men with epidermoid undifferentiated or histologically unclassified

types of bronchial carcinoma only 1.3 per cent were non smokers.

- (6) The occurrence of carcinoma of the lung in a male non smoker or minimal smoker is a rare phenomenon.

In addition to giving us statistical evidence by independent teams in different areas in the United States of America, Wynder and Graham suggest that there is a closer correlation between tobacco smoking and epidermoid and undifferentiated bronchogenic carcinoma than there is between tobacco smoking and adenocarcinoma, where the influence on the development of malignancy appears to be much less.

In Great Britain a painstaking statistical inquiry has been taking place since 1947 and this report has just reached South Africa. R. Doll and A. Bradford Hill (27) sent experienced almoners to interview bronchogenic carcinoma cases reported to them from 20 large hospitals in the London region. In addition to cases of carcinoma of the lung the almoners visited numerous patients with carcinoma of the stomach and large bowel and careful records were also taken from a non cancer control group of general hospital patients of the same sex and age as the lung carcinoma patients.

According to the figures issued by the Registrar General for England and Wales (71) the number of cases of lung carcinoma had increased from 231 cases in 1899 to 612 cases in 1922 to 9287 in 1947 and Doll and Bradford Hill are of the opinion that tobacco smoking can largely be blamed for this increase. Their views can briefly be summarised as follows:-

- (1) Among the smokers a relatively high proportion of the patients in London with carcinoma of the lung fall in the heavy smoking categories.
- (2) Cigarette smoking was more closely related to carcinoma of the lung than pipe smoking.
- (3) No distinct association was found with inhaling.
- (4) As to the nature of the carcinogen they found no evidence. The only carcinogenic substance that is found in tobacco smoke is arsenic but they were not satisfied with the evidence so far produced that arsenic used in spraying could in any way be blamed for the causation of carcinoma of the lung.

Whilst the Bantu do smoke they only do so on a comparatively small scale and Wynder and Graham would have put them in the category of light or minimal smokers. The fact that primary lung cancer occurs less frequently amongst the Natives would tend to confirm the theory that tobacco smoking is an important extrinsic factor.

The matter has been discussed with numerous Native supervisors and compound managers on the mines and they are of the opinion that they seldom see a Native light a cigarette, that few Natives smoke more than 3 or 4 cigarettes a day, and that the vast majority do not buy cigarettes at all but just finish the cigarette ends thrown away by the European miner.

One of my assistants watched approximately 1,000 Natives on 3 days (a total of 3,000 Natives). These miners came to the Witwatersrand Native Labour Association either to be recruited or discharged and spent many hours waiting in the yards. He calculated that during these three days fewer than 50 cigarettes were smoked. Similarly a count at the Silicosis Medical Bureau showed that 3,000 European miners smoked over 5,000 cigarettes during the same number of hours. This rough calculation shows that the European miner smokes approximately 100 cigarettes to one by the Native.

In this connection it is important to note that the Bantu miner cannot afford to buy many cigarettes. His main object is to save money to take back home. A report published by the Natal University College Department of Economics (23) shows that the average cash wages earned by a Bantu miner during the year 1936 was as follows:-

| | |
|----------------------|----------------|
| Cash wages per annum | £31 - 12 - 5d. |
| Value of food | £ 7 - 16 - 0d. |
| Value of housing | £ 4 - 10 - 0d. |
| | <hr/> |
| Total | £43 - 18 - 5d. |
| | <hr/> <hr/> |

Owing to the increase in the cost of living these amounts will be found to have proportionately increased in the year 1950 and the above figures were calculated on the basis of 306 shifts worked per year.

Similarly in Johannesburg a house-boy who receives free board and lodging is to-day usually paid about 5 pounds a month whilst Native labourers in industry receive between 2 and 3 pounds a week and have to house and feed themselves.

In the Native territories some boys have small tobacco patches. Many tribes as reported by Stayt (85) have been growing tobacco for a long time but until recently these were only used for the manufacture of

snuff. Some Natives are fond of using different types of pipes. These have been described by Laider (55) and are usually made of wood, reeds, stone or from the bones of an animal such as an antelope. During a visit by the writer to Portuguese East Africa in July 1948 many of these mine boys were visited in their own homes. Whilst one was most fascinated by and interested in the numerous types of pipes used by the Natives the truth of the matter is that there is no comparison between the large amount of tobacco consumed by the white man and the amount smoked by the Bantu.

In the case of the Xosa and Pondo tribes both men and women smoke and they usually use their own tobacco which they roll into small pieces of brown paper. The tobacco grown by many tribes is said to be different from that obtained in the towns and some mine boys pack their own tobacco into a woven bag and bring it with them to the mines where it is used during their stay of 9 to 12 months.

South Africans smoke both imported and local tobacco. The amount of nicotine in imported tobacco as reported by Gracey (41) ranges from 2% in bright leaf to 5% or more in dark varieties. In addition to nicotine, tobacco contains sugar, starch, salts of acetic, citric, malic and oxalic acid, cellulose

pectic acid, lime albuminous matter and tannin derivatives.

As the Bantu smoke a fair proportion of local tobacco the following pharmacological notes have been taken from a book by Professor J.M. Watt of the Witwatersrand University and M.G. Breyer-Brandwijk (98).

"The dried leaf of *Nicotiana tabacum* L yields 3 to 5 per cent nicotine content for the heavy tobaccos and 1 to 2 per cent nicotine for the lighter tobacco. The Basuto tribes are said to use the leaf of *Nicotiana rustica* L which yields what the Basutos call Koae. This is the South African grown Turkish tobacco and the leaf has been found to yield 6 to 8 per cent nicotine. *Nicotiana glauca* R is a wild tobacco which is poisonous to animals and the air dried leaf contains less than 1 per cent nicotine".

In addition the Bantu smoke dagga (called by them Intsangu). This is the South African "Indian Hemp". It grows like a noxious weed all over South Africa and is extensively cultivated for the extraction of the drug in the Transkei and Transvaal. It does not contain any tobacco.

Many Bantus belonging to different tribes were interviewed with regard to their smoking habits and one can say quite definitely that if only for economic reasons, the average amount of tobacco used by a Bantu is a small fraction of the average quantity smoked by the European.

The facts quoted lend strong support to the theory that tobacco smoking is probably the most important extrinsic factor in the causation of primary lung carcinoma in the European. Whether it is caused by arsenic or by some carcinogen in the tobacco has yet to be proved.

C H A P T E R VI (b).

RELATIONSHIP OF TRAUMA TO PRIMARY NEOPLASMS OF THE LUNG.

R.J. Behan (7) in a medico-legal study of the relationship of trauma to new growths found that the reported incidence of trauma preceding the appearance of primary tumours of the lung varied from zero to 13 per cent.

The following table compiled by the Government Mining Engineer (40) shows the number of accidents that occurred on the Transvaal gold mines during 1945 to 1946.

T A B L E 13.

ACCIDENTS AND DEATHS. TRANSVAAL GOLD MINES. 1945-1946.

| | <u>1945</u> | <u>1946.</u> |
|-----------------------------------|-------------|--------------|
| Transvaal Gold Mines | 23,570 | 21,941 |
| Deaths (White | 28 | 37 |
| (Coloured | 495 | 522 |
| Injuries (White | 2,086 | 2,262 |
| (Coloured | 21,402 | 19,592 |
| Witwatersrand and Extensions Area | | |
| Total Accidents | 23,377 | 21,764 |
| Total Deaths | 516 | 551 |
| Accident Rate | 13.24 | 12.41. |

Amongst the European miners there are over 2,000 cases of injury per year and in many cases we have obtained records of reported chest injuries. Nevertheless out of the 114 European cases described in the appendix we find Case 94 where primary lung carcinoma followed an injury to the ribs but we could obtain no evidence of any injury to the lung.

Knox (11) after a resumé of the literature concludes his chapter on "Trauma and Neoplasms" by writing

" with the advance in our knowledge concerning the nature of cancer and its natural history, it has become more and more clear that there is no reasonable evidence of any relationship between a single injury and the production of a cancer".

Nevertheless, we find in the literature an outstanding case described by Wells and Cannon (99) which fulfils the requirements laid down both by Ewing (31) and Brahdy and Kahn (11). These postulates are:-

1. Definite evidence must be presented by physician that no neoplasm was present at the site of trauma at the time it occurred: there must also be definite proof that the tumour appeared at the site of the injury: Ewing insists that severity of trauma too, must be established.

2. Definite evidence must be presented that some

pathological process persisted at the site of the trauma until the malignant tumour appeared.

3. The nature of the tumour must be diagnosed by microscopic examination.

4. At least a proper interval of time must elapse between the original injury and the subsequent appearance of the tumour.

The history of the case mentioned above and described by Wells and Cannon is as follows:-

" A male patient (aged 50 years) whose previous health was unimpaired was knocked down by an automobile. He had some chest pain, coughed up blood and developed emphysema over the whole body. In addition to this evidence of injury to the lung the x-ray showed fractures of the 3rd, 4th and 5th ribs on the left side but no evidence of carcinoma of the lung. He was in good health and one year later he had pain in the chest, a cough, and an x-ray showed a neoplasm of the left upper lobe. Death occurred one year later and necropsy demonstrated a primary carcinoma of the left upper lobe".

This case is quoted by Simons (81) and others as being definitely traumatic in origin. It could, however, be argued that the tumour was present at the time of the injury and was not shown on the x-ray. One's experience at the Silicosis Medical Bureau shows that the x-ray may not reveal a tumour even where the film was taken during the 12 months preced-

ing the death of the miner.

In the case of the Bantu miner we have over 20,000 cases of injury each year. Here again trauma of the chest is very common and in addition penetrating stab wounds of the chest are of daily occurrence. The knife is frequently used by the Bantu in a brawl or in an argument and when the writer worked at the Johannesburg non-European Hospital he x-rayed hundreds of such cases.

If trauma was an important aetiological factor in the causation of primary lung new growths one would have expected to find many more cases. Whilst fracture of the ribs is not often associated with lung injury no case has yet been recorded at the non-European Hospital where carcinoma of the lung has followed a stab wound.

It would appear that in the case of the Bantu when the intrinsic factor has resulted in a low incidence of carcinoma of the lung, trauma is not an extrinsic or a precipitating factor.

C H A P T E R VI (c).INFLUENZA AND PNEUMONIA - THEIR RELATIONSHIP TO
PRIMARY CANCER OF THE LUNG.

After the first world war many authors considered that the increase in the number of lung tumours was due to the 1918 influenza epidemic. Kikuth (53) mentions that a few years after the 1889 influenza epidemic there was a high percentage incidence of pulmonary carcinoma. F.S. Lister (57) reports that influenza first made its appearance on the Witwatersrand gold mines in September 1918 and rapidly spread and it was only after a fortnight that the non-mining population became seriously affected. Many thousands of European and Bantu miners were stricken but during the period 1921 to 1925 there were only 5 cases of primary carcinoma among the Europeans and no cases in the Bantu. Similarly, P. Kerley (52) quotes the case of Iceland which too had severe epidemics of influenza but where the pathologists have not yet recorded a single case of primary lung carcinoma.

There are two theories as to how influenza could be said to lead to carcinoma. One is that influenza or any bronchial infection causes chronic irritation of the bronchi whilst Katz (51) is of the opinion that bronchial infections lead to metaplasia which he considers to be a pre-cancerous condition.

This theory of metaplasia applies to any inflammatory change and there has always been a very high incidence of pneumonia and other allied acute respiratory diseases in Native miners in South Africa.

Lister (57) writes that

"it has long been known that amongst the South African Natives there is a varying racial susceptibility to acute respiratory infections".

In a careful study he found that the Basutos and the East Coast Natives were the most susceptible.

The following table has been obtained by Dr. D. Ordman from the statistical department of the Johannesburg Chamber of Mines and gives the relevant morbidity and mortality data for acute respiratory diseases in Bantu miners from 1934 to 1942.

The following 2 points should be noted in this table:-

- (1). The figures in brackets indicate the rate per 1,000 per annum.
- (2). From 1939 onwards there is a marked reduction in the absolute number of deaths following the introduction of sulphonamide therapy.

T A B L E 14.

ANALYSIS OF INCIDENCE AND MORTALITY RATES IN RESPIRATORY DISEASES IN THE NATIVE LABOURERS ON THE WITWATERSRAND GOLDFIELDS, 1934-1942.

| | 1934 | 1935 | 1936 | 1937 | 1938 | 1939 | 1940 | 1941 | 1942. |
|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| <u>Acute and chronic bronchitis:</u> | | | | | | | | | |
| Cases | 3,287(13.33) | 3,790(14.06) | 3,201(10.87) | 3,839(12.81) | 4,583(14.60) | 5,623(17.69) | 5,323(15.24) | 5,580(15.25) | 5,057(14.23) |
| Deaths.. .. . | 7(0.03) | 6(0.02) | 5(0.02) | 4(0.01) | 6(0.02) | (1.00) | 7(0.02) | 2(0.01) | 2(0.01) |
| Case mortality rate per cent | 0.21 | 0.16 | 0.16 | 0.10 | 0.13 | 0.02 | 0.13 | 0.04 | 0.04 |
| <u>Pleurisy:</u> | | | | | | | | | |
| Cases.. .. . | 536(2.17) | 612(2.27) | 525(1.78) | 585(1.95) | 586(1.87) | 701(2.21) | 959(2.75) | 537(1.47) | 545(1.53) |
| Deaths.. .. . | 11(0.04) | 6(0.02) | 3(0.01) | 8(0.03) | 4(0.01) | 6(0.02) | 3(0.01) | 5(0.01) | 4(0.01) |
| Case mortality rate per cent | 2.05 | 0.98 | 0.57 | 1.37 | 0.68 | 0.86 | 0.31 | 0.93 | 0.73 |
| <u>Influenza with pulmonary complications:</u> | | | | | | | | | |
| Cases.. .. . | 1,656(6.72) | 1,458(5.41) | 1,498(5.09) | 1,457(4.86) | 1,350(4.29) | 1,371(4.31) | 1,468(4.20) | 1,216(3.32) | 1,355(3.81) |
| Deaths | 67(0.27) | 43(0.16) | 53(0.18) | 61(0.20) | 49(0.16) | 34(0.11) | 39(0.11) | 43(0.12) | 35(0.10) |
| Case mortality rate per cent | 4.05 | 2.95 | 3.53 | 4.20 | 3.63 | 2.48 | 2.66 | 3.54 | 2.58 |
| <u>Bronchopneumonia</u> | | | | | | | | | |
| Cases.. .. . | 813(3.30) | 987(3.66) | 727(2.47) | 839(2.80) | 747(2.38) | 609(1.92) | 626(1.79) | 637(1.74) | 645(1.81) |
| Deaths | 120(0.49) | 136(0.50) | 93(0.32) | 113(0.39) | 83(0.26) | 36(0.11) | 55(0.16) | 62(0.17) | 58(0.16) |
| Case mortality rate per cent | 14.76 | 13.78 | 12.79 | 13.47 | 11.11 | 5.91 | 8.79 | 9.73 | 8.99 |
| <u>Pneumonia (all forms)</u> | | | | | | | | | |
| Cases.. .. . | 7,394(29.99) | 8,364(31.03) | 8,013(27.22) | 8,680(28.95) | 7,774(24.75) | 7,191(22.62) | 9,160(26.23) | 8,783(24.00) | 8,918(25.09) |
| Deaths.. .. . | 792(3.21) | 836(3.10) | 898(3.05) | 970(3.24) | 623(1.98) | 192(0.60) | 207(0.59) | 229(0.63) | 194(0.55) |
| Case mortality rate per cent | 10.71 | 10.00 | 11.21 | 11.18 | 8.01 | 2.67 | 2.26 | 2.61 | 2.18 |
| <u>Lobar Pneumonia</u> | | | | | | | | | |
| Cases.. .. . | 4,925(19.47) | 5,919(21.96) | 5,786(19.66) | 6,384(21.30) | 5,677(18.08) | 5,211(16.39) | 7,066(20.23) | 6,930(18.94) | 6,918(19.46) |
| Deaths.. .. . | 605(2.45) | 657(2.44) | 752(2.55) | 796(2.66) | 491(1.56) | 122(0.38) | 113(0.32) | 124(0.34) | 101(0.28) |
| Case mortality rate per cent | 12.28 | 11.10 | 13.00 | 12.47 | 8.65 | 2.34 | 1.60 | 1.79 | 1.46 |
| Average Population | 246,566 | 269,540 | 294,369 | 299,786. | 314,076 | 317,896 | 349,267 | 365,898 | 355,457 |

During the 9 year period 1934 to 1942 there were only 2 cases of primary lung cancer in the Bantu among 2,882 post-mortems. During this period we had over 100,000 cases of acute and chronic respiratory diseases.

Thus in examining a case of primary bronchial carcinoma one frequently gets a history of the previous incidence of influenza, bronchitis or pneumonia. The fact that respiratory disorders are so common amongst the Bantu mining population would lead one to expect a far greater incidence of primary lung cancer. On the whole the evidence suggests that there has been no causal connection between respiratory diseases and pulmonary carcinoma. Among the Europeans too, owing to wet mining, there are more cases of respiratory disorders than in the general population but this has not led to a greater incidence of primary pulmonary carcinoma.

C H A P T E R VI (d).

PULMONARY TUBERCULOSIS AND PRIMARY CARCINOMA OF THE LUNG.

The records of the Silicosis Medical Bureau (see Table 15) show that in the 31 completed years from August 1st, 1916 to March 31st, 1948 there occurred 32,269 Bantu and 1,268 European cases of pulmonary tuberculosis.

In terms of the legal definition a miner in South Africa is said to have tuberculosis of the lungs when he (a) is expectorating the tubercle bacillus or (b) he has closed tuberculosis to such a degree as seriously both to impair his working capacity and prohibit him from working underground. All European working miners or mine Natives who are found to have tuberculosis are debarred from further work and are granted compensation which in the case of a Bantu miner is always a lump sum.

T A B L E 15.

NUMBER OF CASES OF TUBERCULOSIS FROM 1916 to 1948.
EXAMINATION OF NATIVE LABOURERS.

| Year. | Average No. of all Mine Natives. | Number of Cases of Tubercu- losis | Tuberculosis Prevalence - rate per 1,000 of all Native Labourers. |
|-----------|--|--|---|
| 1916-1917 | 191,202 | 1,355 | 7.07. |
| 1917-1918 | 180,415 | 1,178 | 6.52. |
| 1918-1919 | 171,959 | 1,167 | 6.77. |
| 1919-1920 | 178,571 | 1,188 | 6.64. |
| 1920-1921 | 168,547 | 1,086 | 6.43 |
| 1921-1922 | 160,600 | 783 | 4.87 |
| 1922-1923 | 179,182 | 990 | 5.52. |
| 1923-1924 | 178,006 | 897 | 5.03. |
| 1924-1925 | 180,585 | 831 | 4.60 |
| 1925-1926 | 178,012 | 1,012 | 5.68 |
| 1926-1927 | 184,937 | 1,196 | 6.46. |
| 1927-1928 | 193,976 | 1,143 | 5.89 |
| 1928-1929 | 194,802 | 1,028 | 5.27 |
| 1929-1930 | 195,151 | 984 | 5.04 |
| 1930-1931 | 207,658 | 950 | 4.57 |
| 1931-1932 | 214,155 | 791 | 3.69 |
| 1932-1933 | 222,941 | 782 | 3.51 |
| 1933-1934 | 239,421 | 786 | 3.29 |
| 1934-1935 | 255,816 | 827 | 3.23 |
| 1935-1936 | 281,079 | 925 | 3.29 |
| 1936-1937 | 297,687 | 966 | 3.24 |
| 1937-1938 | 297,515 | 1,012 | 3.39 |
| 1938-1939 | 315,742 | 1,100 | 3.49 |
| 1939-1940 | 328,506 | 1,166 | 3.24 |

TABLE 15 (Cont.)

| Year | Average No. of all Mine Natives. | Number of cases of Tubercu- losis. | Tuberculosis Prevalence - rate per 1,000 of all Native Labourers. |
|-----------|--|---|---|
| 1940-1941 | 359,710 | 1,218 | 3.39 |
| 1941-1942 | 364,084 | 1,324 | 3.63. |
| 1942-1943 | 318,803 | 1,197 | 3.75 |
| 1943-1944 | 298,883 | 1,119 | 3.74 |
| 1944-1945 | 302,663 | 1,166 | 3.85 |
| 1946-1947 | 300,713 | 1,076 | 3.58 |
| 1947-1948 | 290,103 | 1,026 | 3.54 |

TOTAL 32,269.

EUROPEAN MINERS.

| <u>Three Year Period</u> | <u>Number of Cases of Tuberculosis.</u> |
|--------------------------|---|
| 1917 - 1920 | 370 |
| 1920 - 1923 | 151 |
| 1923 - 1926 | 145 |
| 1926 - 1929 | 125 |
| 1929 - 1932 | 98 |
| 1932 - 1935 | 88 |
| 1935 - 1938 | 84 |
| 1938 - 1941 | 80 |
| 1941 - 1944 | 61 |
| 1945 - 1948 | 66 |
| TOTAL | 1,268. |

N.B. 1945 - 1948 Average Annual Number of European
Miners 28,725.

Tuberculosis Prevalence - rate per 1,000 . 78

It has already been noted that during the period 1916 to 1949 the post-mortem examinations revealed six cases of primary bronchogenic carcinoma in the Bantu (See Chapter IV) and 114 cases in the European (see Appendix). Case number 6 in the Bantu and Cases number 18,37,67 in the European showed the presence of both pulmonary tuberculosis and primary lung cancer.

There are three theories as to the relationship of these two diseases:-

- (1) That the presence of pulmonary tuberculosis favours the later development of primary lung cancer.
- (2) The two diseases are mutually antagonistic.
- (3) Each disease follows its own course without limiting or favouring the development of the other.

Ewing (30) formerly believed that the chief aetiological factor of bronchogenic carcinoma was pulmonary tuberculosis. He considered the tubercle bacillus as an irritating agent causing pathological changes in the

bronchi which ultimately led to cancer. Ewing (31), however, revised his opinion in a later edition of his book and writes that

"tuberculosis was formerly the chief aetiological factor but is of diminishing importance".

In Table 15 we noted that 32,269 cases of pulmonary tuberculosis in the Bantu were compensated by the Silicosis Medical Bureau. If pulmonary tuberculosis was an aetiological factor one would have expected to find more than six cases of primary lung cancer post-mortem. Finally as Vinson (92) points out

"the increase of malignant conditions of the lung comes at a time when pulmonary tuberculosis shows a decided decline."

Rokitanski (76) nearly 100 years ago wrote that the rarity of these two diseases in the same person indicated that they were mutually antagonistic. Simons (81) collected 2,941 cases of primary lung carcinoma in the literature and in 283 cases the two diseases were co-existent.

Thibaudeau (88) reports twenty-one cases showing an intimate association between the malignant and tuberculous processes either in the same microscopic field or in adjacent areas. B.M. Fried (35) gives a detailed description of thirteen cases where both diseases were present in the lungs of the same indi-

vidual.

In our series of 120 cases of primary lung carcinoma we have found four cases of co-existent diseases. Whilst this does not give a large percentage of the total it nevertheless suggests that there cannot be a definite incompatibility between pulmonary tuberculosis and primary bronchogenic carcinoma. The low incidence of pulmonary carcinoma in the Bantu miner cannot be explained by the fact that Natives have a higher incidence of pulmonary tuberculosis. If the latter disease prevented the development of malignancy one would still have expected a much higher incidence of primary pulmonary cancer in the million or more Natives who clinically and radiologically never showed any evidence of tuberculosis.

The probabilities are that it is purely accidental when the two diseases co-exist and that one disease does not antagonise or favour the development of the other. The incidence and progress of these two diseases are probably independent of one another.

CHAPTER VI (e).SILICOSIS AND PRIMARY CANCER OF THE LUNG.

The Silicosis Medical Bureau has regularly reported on the incidence of primary cancer of the lung from the year 1932 onwards. The reports show that the number of cases of primary cancer of the lung expressed as a percentage of the total number of post-mortems performed is lower amongst the European miners on the Witwatersrand than the percentage of European males over the age of 20 who have never been underground and who have died at the Johannesburg General Hospital.

Thus, the 1938 Bureau report (14) gives the following results:

(a) Percentage rate of incidence of cases of primary cancer of the lung found post-mortem in European males who had not worked underground in relationship to the total number of post-mortems performed at the Johannesburg General Hospital

1.27 per cent.

(b) Percentage rate of incidence of primary lung cancer for non-silicotic miners

. 74 per cent.

(c) Percentage rate of incidence of primary cancer of the lung for miners who have been certified by the Bureau as silicotic

.72 per cent.

The number of post-mortems performed in each of these three groups was approximately 2,000.

In South Africa a miner is only compensated for silicosis if the x-ray shows definite evidence or if at post-mortem there is palpable nodulation in the lung substance. The diagnosis post-mortem is made on naked-eye evidence since the pathologists of the South African Institute for Medical Research have found that if there is no palpable nodulation then microscopic examination will not reveal the presence of any significant amount of fibrosis.

Dr. L.G. Irvine (14), the Chairman of the Bureau in 1938, discusses the comparative percentage rates of incidence and writes as follows:-

"It will be noted that the proportion of cases of lung cancer amongst all cases examined post-mortem is identical in the group of non-silicotic miners and in that of silicotic miners. This circumstance suggests that amongst miners the development of a definite condition of silicosis does not appear to aggravate the risk of occurrence of lung cancer. This conclusion is the only one which one can draw with certainty from these data taken by themselves. But it must not be overlooked

that those miners in whom a definite development of silicosis did not take place had nevertheless been subjected if not to an equal exposure to silicious dust, at least to a significant exposure".

As Dr. Irvine points out that non-silicotics had been subjected to a significant and in some cases to an equal exposure of dust, it has now become the practice to compare the percentages amongst European miners with those European males over the age of 20 who are not miners and who have died at the Johannesburg General Hospital.

In Table 5 we find that there are 114 cases of primary bronchogenic carcinoma in 8,468 post-mortems, that is, approximately 1.35 per cent.

Dr. B.J.P. Becker (6) finds that the percentage at the Johannesburg General Hospital has now increased to over 3 per cent of the total number of autopsies performed there.

Jones' method shows that the lungs of miners post-mortem have from .3 gram to 8 grams of silica. The opinion held in South Africa has therefore always been that neither dust nor silicosis predisposed to primary lung cancer.

At the Saranac laboratories, New York the late Dr. L.U. Gardener (37) and his successor Dr. A.J. Vorwald have come to the same conclusions.

Vorwald and Karr (94 and 95) collected from the literature the results of roentgenographic examination of 57,362 men at work in industrial plants creating dusts of various kinds. Although this group contained 12,206 cases of silicosis there were only 3 cases of primary lung cancer.

At Saranac laboratory 15,587 men had been exposed to dusty occupations for a long time and radiological examination showed that 1,356 had silicosis. Most of these cases were demonstrated to the writer in 1947. There were only two cases of lung cancer in the whole group.

The authorities at Saranac felt quite definitely that neither dust inhalation nor silicosis had any aetiological significance.

On the other hand there are some writers who feel that there is a connection between malignant disease and silicosis. J.H. Dible (25) found two cases of primary lung cancer in autopsies on 14 cases of silicosis. M.O. Klotz (54) found 4 cases of primary lung carcinoma out of 50 cases of silicosis and felt that pneumoconiosis may play a part in the production of cancer.

The most serious objection to the above statements is that they have been based on the findings of

only a small number of cases.

At Schneeberg in Saxony Germany, Rostoski (78) examined 154 miners and in 21 deaths he found 13 cases of carcinoma of the lung. As every miner there too showed evidence of pneumoconiosis the opinion was expressed that the latter disease must be of aetiological significance. This view has been opposed by leading authorities in Germany and America. Schulte (80) has made a special investigation of the Ruhr miner to see if pneumoconiosis predisposes to pulmonary cancer. He examined 487 cases of definite pneumoconiosis and did not find a single case of cancer. He expressed the opinion that arsenical and radioactive particles were the probable predisposing factors in the cases of carcinoma reported from the Schneeberg miners. Pancoast and Pendergrass (68) reporting on 3 cases of lung carcinoma found in association with pneumoconiosis are of the opinion that the cases of carcinoma of the lung in the Schneeberg mines were obviously due to some factor other than that which causes pneumoconiosis, for at Joachimstal only 30 kilometres away on the Czechoslovakian side of the Erz mountains there was a similar incidence of primary lung cancer without any marked degree of silicosis.

Pirchan and Sikl (69) reported that in Joachimstal

post-mortems were done on 17 miners and 9, that is 53 per cent, were found to have cancer of the lung and in all these cases there was no notable degree of anthracosis or silicosis.

Rostoski, Saupe and Schmorl (77) have shown the bore dust of the Schneeberg mines contain up to .45 per cent arsenic and is somewhat radioactive. Pirchan and Sikl (69) consider that radium emanation must not be regarded as the exclusive aetiological factor as the air of the pits in Joachimstal contains arsenic. They write that

"as arsenic combinations are fairly rapidly absorbed in the body and finally eliminated, the negative result of the chemical analysis of the lung is not a conclusive argument against the importance of arsenic in the aetiology of cancer."

Pancoast and Pendergrass (68) came to the conclusion that in the aetiology of lung cancer at Schneeberg and Joachimstal radium emanation and arsenic must be strongly suspected although it would be difficult to obtain positive proof for the implication of radium emanation.

The following is an analysis by McEwen and Buist (59) of the dust accumulated in the Transvaal Chamber of Mines Laboratory from thousands of routine sugar tube samples of air taken in various parts of every mine on the Witwatersrand.

TABLE 16 SHOWING NATURE OF DUST IN MINE AIR.

| | | | |
|-----------------|--------------------------|---|-----------------|
| Silica | Si O_2 | - | 80.69 per cent. |
| Alumina | $\text{Al}_2 \text{O}_3$ | - | 8.58 per cent |
| Ferric Oxide | $\text{Fe}_2 \text{O}_3$ | - | . 50 per cent. |
| Calcium oxide | Ca O | - | 2.78 per cent |
| Magnesium Oxide | Mg O | - | 1.40 per cent. |

In addition mine air contains carbon particles from acetylene lamps, alkalis, water residue salts derived from the atomisation of mine water used underground, silicates, pyrites, nitrogen, oxygen, carbon monoxide and oxides of nitrogen (nitrous fumes). There is no evidence of any arsenic content. By arranging for large volumes of air to circulate in the mine the carbon monoxide and nitrous fumes are diluted. Fans are installed to downcast the air and filters remove the dust so that samplings now contain under 150 particles per cubic centimetre and the average air available underground per person is about 75 cubic feet. Despite these precautions a miner must inhale a certain amount of these gases, (particularly nitrous fumes after the detonation of explosives) and the relatively lower incidence of lung carcinoma in miners would suggest that these gases are not of aetiological importance.

For at least 25 years it has been known that

radioactive material exist in the Rand rock formation and on the basis of known scientific data it is estimated that there are thousands of tons of uranium ore in the Rand's unmined ore reserves and the Government has introduced legislation to control the mining and use of uranium. It was suggested that radioactive material may be the cause of lung cancer but the statistics of the Bureau did not justify such an inference. In order to see the effect of radiation, the writer examined numerous x-ray films of chest in female patients who had deep x-ray therapy after removal of a malignant breast. In these cases and in the x-rays of those who had been treated by deep x-ray therapy for carcinoma of the lung, a large percentage showed varying degrees of reticular and nodular fibrosis but no tumour changes were produced as a result of the radiation.

Our experience on the Rand mines would suggest that if dust, nitrous fumes, carbon monoxide or radioactive substance were the cause of primary lung cancer one would have expected a higher incidence amongst the miners.

We, however, know that chemical factors such as chromium can cause a high incidence of lung cancer.

Teleky (87) is of the opinion that chromates and radium containing ores are important predisposing

factors. The data on chromium workers is so definite that lung cancer occurring in a worker exposed to chromium dust must be considered to be an occupational disease. Machle and Gregorius (61) reported on 42 cases of lung cancer and showed that it caused 23% of all deaths in the industry and resulted in a death rate that they considered to be 25 times that of the normal.

Similarly, arsenic may be an important aetiological factor and if radioactive substances have not led to a high incidence in the Rand mines it would be reasonable to suggest that one's experience in South Africa would indicate that silica dust and radioactive substances can be excluded and that the most likely extrinsic cause of the high incidence of carcinoma of the lung in Schneeberg and Joachimstal is arsenic.

At the beginning of this chapter it was mentioned that if tobacco smoking was regarded as an important aetiological factor then it is possible that arsenic is the carcinogenic agent.

Bradford Hill (12) has reported that in one town where the principal industrial work is the manufacture of arsenical sheep dip the mortality rate for cancer in the chemical workers was double that of the rest of the population of the town and the difference was

largely made up of cancer of the skin and bronchi.

E. Saupe (79) records two cases of carcinoma of the lung in arsenic miners.

A.J. Amor (3) reported on 10 cases of carcinoma of the lung in workers who had exposed themselves to arsenical dust for an average period of 6 years at the nickel works in South Wales. Recently V.C. Thompson (89) reported that he performed a pneumonectomy for carcinoma of the lung on two of these workers. Both were found to have squamous carcinoma and the lungs contained arsenic.

Summarising the various extrinsic factors that may be of aetiological importance in the causation of primary lung cancer we find that our experience amongst the European and Bantu miners suggests the following:-

- (1) Tuberculosis, trauma, influenza and pneumonia do not appear to be predisposing causes.
- (2) The experience obtained amongst Bantu miners would tend to confirm the current theory that smoking is an important aetiological factor.
- (3) Dust, radioactive substances, nitrous fumes and other contents of the air of the Rand

mines do not cause a high incidence of primary lung cancer.

- (4) It is probable that the extrinsic agent is a chemical one.
- (5) It is suggested that arsenic is the most likely cause of the high incidence at Schneeberg and Joachimstal.
- (6) If arsenic should definitely be proved to have been the cause of the high incidence in Schneeberg and Joachimstal then we have an excellent explanation of the higher incidence amongst heavy smokers of tobacco.

C H A P T E R VII.SUMMARY AND CONCLUSIONS

- (1). Statistics for the European population of the Union of South Africa show a steady yearly increase in the death rate from cancer of all types.
- (2). The Bantu tribes of the Union of South Africa are susceptible to cancer in any part of the body but compared to the Europeans, there is a definite difference in the incidence rate.
- (3). Primary cancer of the lung is common in the European but has a low incidence rate in the Bantu.
- (4). With our present state of knowledge it is accepted that there is both an intrinsic and extrinsic factor in the causation of primary lung cancer.
- (5). The high incidence of primary carcinoma of the liver and the low incidence of primary carcinoma of the lung in the same groups of Bantu miners may be due to an intrinsic racial factor causing a variation in "organ susceptibility". Thus the European lung and the Bantu liver show an increased racial predisposition

to cancer formation.

- (6). It is suggested that as the Bantu appears to have a greater susceptibility to keloids, fibroids, sarcomas and malignant hepatomas following cirrhosis of the liver, then there may be an "accelerating factor" present in the connective tissues of the organs of the Bantu. On the one hand, abnormal proliferation of the connective tissue may result in the formation of keloids, fibroids, sarcomas and malignant hepatomas following cirrhosis of the liver, whilst on the other hand it may exert a "growth restraint" upon any abnormal development of the epithelial cells in contact with them. If this theory is correct it would explain the lower incidence rate of primary lung cancer in the Bantu.
- (7). Tuberculosis, influenza and pneumonia occur commonly in the Bantu miner but these diseases do not appear to predispose to primary lung cancer.
- (8). Whilst trauma is sometimes accepted as being associated with tumour formation there does not appear to be a single case among the 120 miners described in this series, where trauma can de-

finitely be said to have led to the production of cancer.

- (9). As the Bantu is a "minimal smoker" of cigarettes the low incidence of primary lung cancer in the Bantu lends strong support to the theory of Doll and Bradford Hill in Great Britain and Wynder and Graham in the United States of America that tobacco smoking is probably the most important extrinsic factor in the aetiology of primary cancer of the lung. The carcinogenic factor may be in the tobacco or it may be due to the arsenic used in the spraying of the tobacco plants.
- (10). In the Rand mines, silica dust, nitrous fumes, carbon monoxide gas and radioactive substances do not cause a higher incidence of primary lung cancer.
- (11). Reasons are given for suggesting that the high incidence rates for primary carcinoma in the lung in Schneeberg and Joachimstal were probably due to arsenic.
- (12). Six Bantu and 114 European cases of primary carcinoma of the lung (all cases of primary bronchogenic carcinoma) are surveyed and compared, and the hope is now expressed that

further anthropathological studies by cancer experts will follow.

A P P E N D I X.

This appendix contains the reports of 114 European miners whose lungs, post-mortem, showed evidence of a primary bronchogenic carcinoma. In every case the pathologist has confirmed the diagnosis by microscopic examination though some of these reports were not handed in with the macroscopic report.

Each report contains

- (1) the age at death.
- (2) the number of years the miner has worked under-ground.
- (3) the main features found at the last, the six monthly or yearly clinical examinations.
- (4) the last x-ray report.
- (5) the post-mortem report.

It is part of the writer's duties to read about 200 x-ray reports each day and the post-mortem reports have been issued by the pathologists of the South African Institute for Medical Research and confirmed by the Silicosis Medical Bureau.

C A S E I.

AGE: 75 Years.

UNDER GROUND SERVICE: 14 years.

MAIN FEATURES OF CLINICAL EXAMINATION (Six months before death).

Weights 115 pounds. Has lost 9 pounds in last 6 months. Coughing for over a year. Sputa blood streaked. Sputum negative for tuberculosis. He is fit for no work. On stethoscopic examination a few scattered rhonchi are heard over both lung fields.

RADIOLOGICAL REPORT: (Six months before death).

Generalised fibrosis. Opacity lower left lung field with appearances suggestive of primary carcinoma of that lung.

POST-MORTEM REPORT:

RIGHT LUNG 780 grams. LEFT LUNG 610 grams. HEART 230 grams.

ROOT GLANDS show moderately marked enlargement, deep pigmentation and dense fibrosis. Some on the left are infiltrated with tumour. There is a well marked chronic periadenitis.

PLEURAE show moderate pigmentation with moderately numerous irregular plaques and scars.

LUNGS: Section of the lungs show moderate pigmentation with an occasional palpable irregular islet and one or two small areas of massive fibrosis. In the left lung

is a carcinoma arising at the root and infiltrating extensively into the apical portion of the basal lobe. There is no overt tuberculosis. A few foci of metastatic tumour are present in the right lung. There is well marked chronic bronchitis and emphysema but no significant atheroma.

HEART is small and atropic. Coronary vessels show atheroma with calcification.

MICROSCOPIC SECTIONS of the pigmented areas lying in the tumour mass show the structure of silicotic fibrosis which is infiltrated by adenocarcinoma.

C A S E 2.

AGE: 60 years.

UNDER GROUND SERVICE: 15 years.

MAIN FEATURES OF CLINICAL EXAMINATION. (Eight months before death).

Weight 166 pounds. Lost 24 pounds in last 27 months. Coughing for over a year. Sputum blood streaked. Pain left side of chest. Dyspnoeic. Breath sounds reduced left base with occasional crepitations at the base of the right lung.

RADIOLOGICAL REPORT. (Eight months before death).

Generalised fibrosis. Opacity at the base of the right lung field suggestive of consolidation. Appearances suggestive of an associated primary carcinoma of the base of the right lung.

POST-MORTEM REPORT:

RIGHT LUNG: 860 grams. LEFT LUNG 610 grams. HEART 310 grams.

ROOT GLANDS are moderately enlarged, moderately pigmented and densely fibrosed. Some on the right show tumour infiltration.

PIEURAE show moderate pigmentation with occasional plaque formation and slight scarring. Right Pleura is thickened and there is an abundant fibrinous exudate over the right basal lobe.

LUNGS. Section of the lung shows moderate pigmentation

with a few palpable islets. In the left apical lobe is a small fibro-caseous focus but there is no overt tuberculosis in the lung substance. At the root of the right lung is a primary carcinoma and the right basal lobe shows septic broncho-pneumonia with bronchiectasis. There is a well marked chronic bronchitis and a moderate degree of emphysema.

HEART muscle shows atrophy and fatty changes.

MICROSCOPIC SECTIONS of this growth of the lung show the structure of Squamous Carcinoma.

C A S E 3.

AGE: 58 years.

UNDERGROUND SERVICE 2 years.

MAIN FEATURES OF CLINICAL EXAMINATION (Two months before death).

Complains of pain in the chest and the pain radiates down the left arm. Sputum negative for tuberculosis. Broncho-vesicular breathing left upper lung field.

RADIOLOGICAL REPORT: (Two months before death).

No evidence of silicosis or of tuberculosis. There is an opacity of the left upper lung field. Appearances suggest primary bronchial carcinoma of the left lung.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, pigmented and fibrosed. On the left side there is infiltration with tumour.

PLEURAE shows moderate pigmentation but no plaque formation.

LUNGS show moderate pigmentation but no evidence of silicosis or of overt tuberculosis. There is a carcinoma at the root of the left lung with infiltration of the lung substance and septic pneumonia with cavity formation. There is a well marked chronic bronchitis.

MICROSCOPIC SECTIONS of this growth of the lung show the structure of a squamous carcinoma of bronchial origin.

C A S E 4.

AGE: 56 years.

UNDERGROUND SERVICE: 5 years.

MAIN FEATURES OF CLINICAL EXAMINATION (Two months before death).

Weight 134 pounds. Has lost 11 pounds in the last four years. Complaining of epigastric pain. Percussion note impaired over the right upper zone with scattered rhonchi in both lungs.

RADIOLOGICAL REPORT: (Two months before death).

Generalised fibrosis. There is an opacity of the right upper lung field, with appearances suggestive of a primary carcinoma of that lung.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, moderately pigmented and fibrosed.

PLEURAE show moderate pigmentation with irregular plaque formation and scarring. Over the right apical lobe there is malignant infiltration.

LUNGS. Section of these lungs shows moderate pigmentation with sparse palpable islets in the apical lobes. There is no overt tuberculosis. The major portion of the right apical lobe is replaced by a large malignant growth. There is a moderate degree of chronic

bronchitis, a purulent bronchitis is also present and there are areas of septic broncho-pneumonia.

HEART shows atrophy and the vessels show patchy atheroma.

MICROSCOPIC SECTIONS of the growth in the lung, pulmonary root glands and in cerebellum show the structure of a squamous carcinoma which is probably of lung origin.

C A S E 5.

AGE: 50 years.

UNDERGROUND SERVICE: 9 years.

MAIN FEATURES OF CLINICAL EXAMINATION (Three months before death)

Weights 183 pounds. Has lost 17 pounds in past year. There is a pleural rub at the left base.

RADIOLOGICAL REPORT: (Three months before death).

There is a generalised small mottling of silicotic origin with marked pleural thickening in both lung fields.

POST-MORTEM REPORT:

ROOT GLANDS are enlarged, pigmented and infiltrated by tumour.

PLEURAE are both covered by numerous nodules of tumour, a large proportion of which are confluent. Ribs and diaphragm are also studded with tumour nodules. The features are those of an endothelioma of the pleurae.

MICROSCOPIC SECTION OF LUNGS shows increase in pigment aggregated in moderately numerous small to medium sized islets of silicotic character, an occasional small focus of tumour is present close to the pleural surface of the lungs. Chronic bronchitis is present. There is no evidence of tuberculosis.

C A S E 6.

AGE: 52 years.

UNDERGROUND SERVICE: 26 years.

MAIN FEATURES OF CLINICAL EXAMINATION (One month before death).

Complaining of shortness of breath. Wasserman strongly positive. Sputum positive for tuberculosis.

RADIOLOGICAL REPORT: (Eleven years before death).

There is a generalised fibrosis with a small silicotic mottling in the upper thirds of both lung fields.

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged, markedly pigmented and markedly fibrosed. There is a well marked chronic peri-adenitis. There is no overt tuberculosis.

PLEURAE show moderate increase in pigment with the formation of numerous plaques. There is scarring at the right apex and there are old dense adhesions over the right lung.

LUNGS. Sections of the lungs show moderately marked increase in pigment aggregated in moderately numerous medium to large size islets diffusely scattered throughout both lungs. In the right apical lobes, in the sub-apical region, is an area of massive fibrosis

of tuberculo-silicotic type and in it there is an old cavity containing pus. In this lobe there is a primary carcinoma. There is a well marked chronic bronchitis affecting the larger bronchi and there is marginal emphysema.

HEART shows chronic endocarditis of mitral and aortic valves and there is gross atheroma and calcification of the aorta.

MICROSCOPIC SECTIONS of this growth of the lung show the structure of oat seed type of bronchial carcinoma.

C A S E 7.

AGE: 54 years.

UNDERGROUND SERVICE: 8 years.

MAIN FEATURES OF CLINICAL EXAMINATION. (Three months before death).

Coughing up dark yellow sputa. Feels very short of breath. Bilateral rhonchi. Sputum negative for tuberculosis.

RADIOLOGICAL REPORT (Six months before death). There is a generalised fibrosis. There is an opacity of the upper half of the left lung field with appearances suggestive of a primary bronchial carcinoma associated with marked thickening of the pleurae.

POST-MORTEM REPORT:

ROOT GLANDS. On the right side are moderately enlarged; moderately pigmented and densely fibrosed. On the left the glands are much enlarged and extensively infiltrated by tumour.

PLEURAE. On the left side are dense adhesions over the whole lung. On the right side there is a moderate increase in pigment with moderately numerous palpable medium sized plaques. There is much scarring at the apices.

LUNGS. Sections of the lungs show moderate increase

in pigment with an occasional palpable small islet in the apices. There is no overt tuberculosis. In the left lung there is a carcinoma of the bronchus with extensive infiltration into the apical lobe. In the basal lobe is a septic broncho-pneumonia with acute bronchiectatic cavity formation. There is a moderate degree of chronic bronchitis and emphysema.

HEART is atrophic. There is slight atheroma of the coronary vessels.

MICROSCOPIC SECTIONS of this growth of the lung show the structure of a primary bronchial carcinoma.

C A S E 8.

AGE: 59 years.

UNDERGROUND SERVICE: 39 years.

MAIN FEATURES OF CLINICAL EXAMINATION (Three months before death).

Has no cough. Is well nourished. No sputa available for examination. Has a hemiplegia with aphasia and paralysis of the right arm and right leg.

RADIOLOGICAL REPORT: (Three months before death).

Has a generalised fibrosis with silicotic mottling in both lung fields. There is an opacity of the left lung suggestive of a primary carcinoma of the left lung with numerous small metastases in both lung fields.

POST-MORTEM REPORT:-

ROOT GLANDS enlarged and tuberculo-silicotic.

PLEURAE show marked increase in pigment with plaque formation on the right. On the left there is a carcinomatous infiltration of the pleura over the upper lobe. Adhesions are present over the lower lobe.

SECTION OF THE LUNG shows considerable increase in pigment aggregated in moderately numerous small islets of which a number are palpable. In the apices are two small areas of tuberculo-silicotic fibrosis. There is no active tuberculosis. The left upper bronchus is

the seat of carcinomatous infiltration and there are numerous nodules of carcinoma in the upper lobe. There is no bronchiectasis.

MICROSCOPIC SECTIONS of the left lung show the structure of a carcinoma of bronchial origin.

There is a haemorrhagic cavity about two inches in diameter in the left cerebral hemisphere in the pre-Rolandic area.

C A S E 9.

AGE: 79 years.

UNDERGROUND SERVICE: 6 years.

MAIN FEATURES OF CLINICAL EXAMINATION (Two months before death).

Coughing up a dark yellow sputum. Has pains in the abdomen. On examination is dull over the left base, pronounced vesicular breathing with an occasional rhonchus in both lungs.

RADIOLOGICAL REPORT: (Two months before death).

There is no evidence of silicosis. There is an opacity in the left mid zone suggestive of consolidation which may be associated either with tuberculosis or a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, pigmented and fibrosed.

The left pleurae show a few adhesions. There is a slight increase in the sub-pleural pigment but no palpable fibrosis.

On Section the lungs show a slight increase in pigment but no definite evidence of silicosis. In the left lung there is a large mass of pigmented and infected fibrosis with broncho-pneumonia and gangrene

There is no evidence of tuberculosis.

MICROSCOPIC SECTIONS from this mass show the structure of a carcinoma probably of primary bronchial origin.

C A S E 10.

AGE: 50 years.

UNDERGROUND SERVICE: 30 years.

MAIN FEATURES OF CLINICAL EXAMINATION (Two months before death) Weighs 148 pounds. Has lost 10 pounds in the last 6 months. Haemoptysis about three months ago. On examination there is bronchial breathing over the right upper lung with occasional rhonchi and whispering pectoriloquy.

RADIOLOGICAL REPORT: (Two months before death). There is a generalised fibrosis with an opacity in the right mid zone which three years previously had been diagnosed as a primary neoplasm of the right lung.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, pigmented and densely fibrosed. Some on the right side are infiltrated with tumour. There is a well marked chronic periadenitis.

PLEURAE shows moderate pigmentation with irregular palpable plaques and scars over the apical lobes. There are dense adhesions over the right lung.

LUNGS. Section of the lungs shows moderate pigmentation with moderately numerous medium sized, palpable islets

situated mainly in the apical lobes. In the right upper bronchus there is tumour infiltration which extends into the apical lobes. Here, there is septic broncho-pneumonia and gangrene. There is also pneumonic consolidation in the basal lobes of both lungs. There is a well marked bronchitis and moderate degree of emphysema

C A S E 11.

AGE: 57 years.

UNDERGROUND SERVICE: 14 years.

MAIN FEATURES OF CLINICAL EXAMINATION. (Three months before death) The only complaint is shortness of breath. Nothing abnormal was found on physical examination. of the chest.

RADIOLOGICAL REPORT: (Three months before death) There is generalised medium mottling of silicotic origin with an opacity over the right upper lung field; which has been noted too, about a year ago. The appearances suggest a primary lung carcinoma with pleural thickening on the right side.

POST-MORTEM REPORT:

ROOT GLANDS: Moderately marked enlargement, moderate pigmentation and dense fibrosis. Some are infiltrated by tumour.

PLEURAE: There is an abundant fibrinous exudate over the right lung. Left pleura shows moderate increase in pigment with moderately numerous irregular palpable plaques.

LUNGS: Section of lungs shows moderate increase in pigment with moderately numerous medium sized to large

sized islets distributed throughout both lungs. There is no overt tuberculosis. In the right upper bronchus there is a carcinoma which is infiltrating the lung. There is septic broncho-pneumonia in the right lung. Metastatic nodules of tumour are present in the left lung. There is a marked degree of bronchitis. Heart is not enlarged. Moderate degree of atheroma in the coronary vessels.

C A S E 12.

AGE: 58 years.

UNDERGROUND SERVICE: 6 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (Five months before death). Weighs 155 pounds. Has lost 10 pounds in the past 6 months. Coughing blood streaked sputa. Vomits frequently. Very breathless. On examination percussion note is dull over the right apex with harsh broncho-vesicular breathing over that area. Wasserman is strongly positive.

RADIOLOGICAL REPORT: (Five months before death) There is a generalised fibrosis with an opacity over the upper half of the right lung field noted for the past two years.

POST-MORTEM REPORT:

ROOT GLANDS: are enlarged, pigmented and fibrosed. Some are soft from oedema. A well marked periadenitis is present. There are adhesions over both pleurae which also show increase in pigment with formation of moderately numerous plaques.

LUNGS: Sections of lungs show increase in pigment with the formation of moderately numerous palpable medium sized islets situated mainly in the apical lobes. There is no overt tuberculosis. Chronic bronchitis and

bronchiectasis are present and there is a primary lung carcinoma at the root of the right lung in the region of the right upper bronchus.

C A S E 13.

AGE: 57 years.

UNDERGROUND SERVICE: 10 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (Eight years before death) Nothing abnormal to note.

RADIOLOGICAL REPORT: (Eight years before death) There is a general fibrosis but no other evidence of pathology.

POST-MORTEM REPORT:

ROOT GLANDS moderately enlarged, pigmented, deeply fibrosed - well marked chronic periadenitis.

PLEURAE: Left shows irregular patchy thickening and a fibrinous exudate. Right pleura shows moderate pigmentation with incipient plaque formation.

LUNGS: Section of lungs shows moderate pigmentation with a very occasional palpable small islet. There is no overt tuberculosis. At the root of the left lung is a carcinoma with cavity formation and haemorrhage. An extensive septic broncho-pneumonia is present in the left lung. Well marked bronchitis and moderate emphysema.

HEART. Coronary vessels show marked atheroma with narrowing.

C A S E 14.

AGE: 49 years.

UNDERGROUND SERVICE: 3 years.

MAIN FEATURES OF CLINICAL EXAMINATION (One month before death). Very dyspnoeic. Coughing up a yellow sputum. On examination the percussion note is impaired over the right upper zone and the breath sounds are reduced.

RADIOLOGICAL REPORT: (One month before death) There is a generalised small mottling over the right upper zone and this has been noted for the past 2 years. The appearances are those of a primary carcinoma of the right apical lobe.

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged, moderately pigmented and densely fibrosed. Some show mucous infiltration. There is a well marked chronic periadenitis.

PLEURAE: Over the right apical lobe there is tumour infiltration. Left pleura shows moderate pigmentation with irregular plaque formation. There is scarring at the apex.

LUNGS: Section shows moderate pigmentation with moderately numerous palpable medium sized islets distributed throughout both lungs. There is no overt tuber-

culosis. In the right apical lobe there is expansive infiltration by a primary carcinoma of the lung. There is well marked bronchitis and a moderate degree of emphysema.

HEART is atrophic. Coronary vessels show no significant changes.

There are secondaries in the liver.

C A S E 15.

AGE: 61 years.

UNDERGROUND SERVICE: 15 years.

MAIN FEATURES OF CLINICAL EXAMINATION (One month before death). Coughing blood streaked sputa. Wasserman negative. Sputum negative for tuberculosis.

RADIOLOGICAL REPORT: (One month before death). There is no evidence of silicosis. There is an opacity at the right base and appearances are suggestive of pleural thickening which may be associated with an underlying neoplasm.

POST-MORTEM REPORT:

ROOT GLANDS moderately enlarged, densely pigmented and slightly fibrosed.

PLEURAE. There is an abundant fibrinous exudate over the right lung. Left Pleura shows moderately marked increase in pigment with occasional plaque formations.

LUNGS: Section of lungs shows moderate increase in pigment but no definite evidence of silicosis. There is no overt tuberculosis. At the root of the right lung is a tumour-like infiltration with septic broncho-pneumonia. In the right lung well marked bronchitis is present.

MICROSCOPIC sections of mass at root of the right lung show the structure and features which are those of a primary bronchogenic carcinoma.

C A S E 16.

AGE: 45 years.

UNDERGROUND SERVICE: 20 years.

MAIN FEATURES OF CLINICAL EXAMINATION (Two months before death). Very short of breath. Has a dry cough. Has put on 5 pounds in weight during the last 6 months.

RADIOLOGICAL REPORT: (One month before death). There is marked enlargement of the left hilar region suggestive of a primary bronchial carcinoma. Numerous rounded opacities are present in both lung fields and these have the appearances of multiple secondary tumours.

POST-MORTEM REPORT:

ROOT GLANDS shows moderately marked enlargement, moderate pigmentation and dense fibrosis. Some are infiltrated by tumour. A well marked chronic periadenitis is present.

PLEURAE shows moderate increase in pigment but no plaque formation. Numerous nodules of tumour are studded over both lungs and there is an extensive infiltration of the left pleura, posteriorly, at the root of the lung in the apical lobe.

LUNGS. Section of these lungs shows moderate pigment but no evidence of silicosis. There is no overt tuberculosis. In the left bronchus is a carcinoma and

there are numerous metastatic nodules throughout both lungs. There is a well marked bronchitis with moderate marked emphysema.

HEART: A nodule of tumour is present at the apex of the left ventricle.

KIDNEYS show metastatic nodules. There are also metastases in the skull and liver.

C A S E 17.

AGE: 67 years.

UNDERGROUND SERVICE: 43 years.

MAIN FEATURES OF CLINICAL EXAMINATION (Two months before death). Has lost 36 pounds in the last 6 months. Recent haemoptysis.

RADIOLOGICAL REPORT: (Two months before death). There is no evidence of silicosis and no other evidence of lung pathology.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, densely pigmented and densely fibrosed.

PLEURAE are moderately pigmented and show some small palpable plaques.

LUNGS on section show a slight to moderate increase in pigment but no evidence of silicosis. There is no overt tuberculosis. Slight emphysema is present and there is bi-lateral broncho-pneumonic consolidation. At the left root area is a focus of early carcinoma.

MICROSCOPIC SECTIONS of this tissue show the presence of a squamous carcinoma.

C A S E 18.

AGE: (at death) 53 years.

UNDERGROUND SERVICE: 2 years.

MAIN FEATURES OF CLINICAL EXAMINATION (28 years before death) Nothing abnormal was noted at this examination and there is no definite information with regard to his underground service during this period.

RADIOLOGICAL REPORT: (28 years before death) No evidence of any chest pathology.

POST-MORTEM REPORT:

RIGHT LUNG: 800 grams. LEFT LUNG 660 grams. HEART 400 grams.

ROOT GLANDS moderately enlarged, deeply pigmented and fibrosed.

PLEURAE are moderately pigmented and show a few palpable plaques.

LUNGS: On section show a moderate increase in pigment and occasional silicotic islets. Foci of dense pigmented fibrosis are present in the apical lobes.

Primary bronchogenic carcinoma is present at the right apex. Chronic cavernous tuberculosis is present at the left apex.

HEART is slightly enlarged. The coronary vessels are healthy.

OPINION: There is slight to moderate degree of silico-

sis complicated by tuberculosis and carcinoma.

Haemorrhage appears to have taken place from the left apical tuberculous cavity, so that the silicosis may have been a factor in the cause of death.

MICROSCOPIC SECTIONS of right lung show the presence of bronchogenic spheroidal celled carcinoma

C A S E 19.

AGE: 53 years.

UNDERGROUND SERVICE: 16 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (Four months before death) Coughing blood streaked sputa. Very short of breath. On examination crepitations are heard over the right base.

RADIOLOGICAL REPORT: (Four months before death). There is no evidence of silicosis. An opacity has been noted over the right base for the past two years. The appearances suggest a primary carcinoma of the right lung.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged and deeply pigmented but are not fibrosed.

PLEURAE show a moderate increase in pigment and the presence of some plaque formation. The right pleura is partly obscured by fibrous thickening and there are a few tags of fibrous adhesions on the left.

LUNGS: On section show a moderate increase in pigment but there is no evidence of silicosis. Broncho-pneumonic consolidation is present in both lungs. There is no overt tuberculosis. A carcinoma with necrosis and cavity formation is present in basal area of the right lung.

HEART shows no significant pathological change.

MICROSCOPIC SECTIONS of this lung tissue show the presence of a squamous carcinoma.

C A S E 20.

AGE: 76 years.

UNDERGROUND SERVICE: 22 years.

MAIN FEATURES OF CLINICAL EXAMINATION (Three months before death). Dry cough. Very short of breath. On physical examination crepitations are heard over the upper zone of the left lung.

RADIOLOGICAL REPORT: (Three months before death).

A generalised fibrosis is present with a pleural effusion on the left side. Previous films do not indicate the nature of the underlying pathology.

POST-MORTEM REPORT:

RIGHT LUNG: 590 grams. LEFT LUNG 680 grams. HEART 430 grams.

ROOT GLANDS: are moderately enlarged and deeply pigmented. Some are partially fibrosed.

PLEURAE are moderately pigmented and show the presence of some palpable plaques. Fibrous adhesions are present on both sides.

LUNGS: On section show a moderate increase in pigment aggregated in discrete islets a few of which are palpable particularly in the apical area of the right lung. There is no overt tuberculosis. Carcinoma is present in the left lung and there is also pneumonic consolidation and partial collapse of the left lung.

HEART shows the presence of left ventricular hypertrophy and of slight atheromatous change in the coronary vessels.

OPINION: There is a slight degree of silicosis which was not a factor in the cause of death.

MICROSCOPIC SECTION of this lung tissue shows the presence of a squamous celled carcinoma.

C A S E 21.

AGE: 64 years.

UNDERGROUND SERVICE: 22 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (14 months before death). Dyspnoeic. Blood streaked sputa. On examination broncho-vesicular breathing heard over the right upper zone. Sputum negative for tuberculosis.

RADIOLOGICAL REPORT: (12 months before death). There is no evidence of silicosis. An opacity has been noted over the upper third of the right lung field for the past 18 months. The appearances are those of a primary bronchial carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged and deeply pigmented. Some are fibrosed.

PLEURAE show marked pigmentation but no plaque formation. Tags of fibrous adhesions are present on the right side.

LUNGS: On section show a moderate increase in pigment but no evidence of silicosis. The right apical lobe is consolidated. No metastases.

HEART shows no significant lesion.

MICROSCOPIC SECTIONS of this lung tissue show the presence of dense fibrosis associated with an oat cell carcinoma of bronchial origin and collapse of the lung.

C A S E 22.

AGE: 49 years.

UNDERGROUND SERVICE: 4 years.

MAIN FEATURES OF CLINICAL EXAMINATION (four months before death). Haemoptysis. Very short of breath. Breath sounds reduced over left base.

RADIOLOGICAL REPORT: (Four months before death). There is no evidence of silicosis. An opacity is present at the base of the left lung field. Appearances are those of an abscess which is probably secondary to a primary carcinoma of the left lung.

POST-MORTEM REPORT:

ROOT GLANDS are not fibrosed.

PLEURAE show slight pigmentation but no plaque formation.

LUNGS. No evidence of silicosis or of tuberculosis. There is a moderate degree of bronchitis and emphysema. There is an abscess at the base of the left lung with a surrounding carcinoma. Metastases are present in the liver.

C A S E 23.

AGE: 52 years.

UNDERGROUND SERVICE: 26 years.

MAIN FEATURES OF CLINICAL EXAMINATION (one month before death). Has a moderate cough. Is very short of breath. Nothing abnormal to note on physical examination.

RADIOLOGICAL REPORT: (One month before death). There is a generalised fibrosis. Left hilar region is enlarged and appearances suggest a primary carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG: 900 grams. LEFT LUNG: 1310 grams. HEART: 390 grams

ROOT GLANDS are much enlarged, moderately pigmented and fibrosed - many are extensively infiltrated by tumour.

PLEURAE on left side there is extensive infiltration by tumour - there is moderate pigmentation with occasional plaque formation and scarring.

LUNGS. On section shows moderate pigmentation with an occasional palpable small islet. In the left apical lobe is extensive infiltration by carcinoma. There is a well marked chronic bronchitis. Basal lobes are congested.

HEART: Coronary vessels show patchy atheroma with

calcification and stenosis.

MICROSCOPIC SECTIONS show the presence of a primary bronchogenic (oat cell) carcinoma.

Sections of the brain and liver show the presence of an oat cell carcinoma of bronchial origin.

C A S E 24.

AGE: 57 years.

UNDERGROUND SERVICE: 20 years.

MAIN FEATURES OF CLINICAL EXAMINATION (7 months before death). Sputum blood streaked. Very short of breath. On physical examination percussion note is impaired over the left base. Breath sounds are reduced and crepitations are heard over the inferior angle of the left scapula and over the left base.

RADIOLOGICAL REPORT: (7 months before death). There is a generalised fibrosis with silicotic mottling in the upper thirds of both lung fields. An opacity has been noted at the left base for the past three years and the appearances are those of a primary lung carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG: 850 gms. LEFT LUNG: 1050 gms. HEART: 220 gms.

ROOT GLANDS are much enlarged, moderately pigmented and densely fibrosed - some are extensively infiltrated by tumours.

PLEURAE there is great thickening of pleura over the left lung. Right pleura shows pigmentation, fibrinous exudate and nodules of metastatic tumour.

LUNGS. Section of the lungs shows moderate pigmentation with an occasional palpable islet in the apical lobes. There is no overt tuberculosis. In the left lung is extensive carcinomatous infiltration from roots into the basal lobe. There is also a septic broncho-pneumonia. A few nodules of metastatic tumour are present in the right lung. There is a well marked chronic bronchitis but no tuberculosis.

HEART is small and atrophic.

MICROSCOPIC SECTIONS show the presence of a primary bronchogenic carcinoma of the left lung.

C A S E 25.

AGE: 50 years.

UNDERGROUND SERVICE: 27 years.

MAIN FEATURES OF CLINICAL EXAMINATION (15 months before death). Sputum is now blood streaked. Is very short of breath. Sputum negative for tuberculosis.

RADIOLOGICAL REPORT: (15 months before death).

There is a generalised fibrosis with silicotic mottling in the upper thirds of both lung fields. There is an opacity in the left mid zone which is probably caused either by tuberculosis or a primary lung carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG: 650 grams. LEFT LUNG: 1010 grams. HEART:
240 grams.

ROOT GLANDS are pigmented and moderately fibrosed.

On the left side they are grossly infiltrated by tumour.

PLEURAE show moderate pigmentation with occasional plaque formation. Adhesions are present, particularly on the left side.

LUNGS. Section of the lungs shows moderate pigmentation with a very occasional palpable small islet. There is no overt tuberculosis.

In the left lung is a primary carcinoma of the bronchus with extensive invasion of the apical lobe.

There is a well marked chronic bronchitis and emphysema.

HEART shows atrophy. Coronary vessels show gross atheroma.

MICROSCOPIC SECTIONS show the presence of a squamous carcinoma of bronchial origin.

Metastases are present in the brain.

C A S E 26.

AGE: 45 years.

UNDERGROUND SERVICE: 24 years.

MAIN FEATURES OF CLINICAL EXAMINATION (21 months before death). Sputum is blood streaked. Is very short of breath. On examination crepitations are heard over the left base. Sputum is negative for tuberculosis.

RADIOLOGICAL REPORT: (Six months before death). Generalised fibrosis is present with an opacity at the base of the left lung field. This opacity has been noted for over two years and the appearances are suggestive of a primary lung carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, moderately pigmented and fibrosed. On the right side they are infiltrated with tumour.

PLEURAE. Dense fibrous adhesions over both lungs with thickening of the pleurae.

LUNGS. Sections of the lung show moderate pigmentation with moderately numerous medium sized palpable islets throughout the lung substance. In the left basal lobe is an extensive carcinoma producing consolidation of the whole lobe. A few foci of tumour are present in the apical lobe. No overt tuberculosis. There is moderate bronchitis and emphysema.

C A S E 27.

AGE: 56 years.

UNDERGROUND SERVICE: 23 years.

MAIN FEATURES OF CLINICAL EXAMINATION. (7 months before death). Sputum is dark yellow. Is very short of breath. Has lost 10 pounds in the last 6 months. Nothing definite on physical examination.

RADIOLOGICAL REPORT: (7 months before death). A Generalised fibrosis is present. There is no other evidence of pathology.

POST-MORTEM REPORT;

ROOT GLANDS are much enlarged - moderately pigmented and densely fibrosed. Some show calcification - others show tumour infiltration. There is a well marked chronic periadenitis.

PLEURAE show moderate pigmentation with occasional palpable plaque formation. There are dense adhesions over the left apical lobe where there is carcinomatous infiltration.

LUNGS. Section of the lung shows moderate pigmentation with sparse, just palpable islets in the apical lobes. In the left apical lobe is an extensive carcinomatous infiltration with pneumonic consolidation. No overt tuberculosis. Well marked bronchitis and emphysema.

MICROSCOPIC SECTION of this lung tissue shows the

presence of oat seed carcinoma which has originated in one of the large bronchi.

Metastases are present in the liver.

C A S E 28.

AGE: 62 years.

UNDERGROUND SERVICE: 26 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (8 months before death). Has a dry cough. Is very short of breath. Has picked up 7 pounds in weight during the last 6 months.

RADIOLOGICAL REPORT: (8 months before death). A generalised fibrosis is present. An opacity in the right mid zone has been noted for the past 7 months and the appearances are suggestive of a primary lung carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS: On the right side are much enlarged, moderately pigmented but not definitely fibrosed. They are the seat of carcinomatous infiltration. The glands on the left side are moderately enlarged, pigmented and fibrosed.

PLEURAE: show a moderate degree of pigmentation, a few small plaques are palpable. Occasional sub-pleurae malignant plaques are palpable.

LUNG on section shows a moderate increase in pigment aggregated in medium sized islets, one or two of which are just palpable in the apical lobes. No overt

tuberculosis. Marked bronchitis and a moderate emphysema. In the apical lobe of the right lung there is a carcinoma originating in one of the small bronchi and from this site there is some localised extension of the growth by permeation of the lymphatics.

MICROSCOPIC SECTIONS show a carcinoma of oat seed type.

Metastases are present in the liver.

C A S E 29.

AGE: 53 years.

UNDERGROUND SERVICE: 6 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (6 months before death) Has dry cough. Nothing abnormal to note on physical examination.

RADIOLOGICAL REPORT: (2 years before death) Generalised fibrosis. No other evidence of pathology.

POST-MORTEM REPORT:

ROOT GLANDS in the left lung are slightly enlarged, pigmented and fibrosed. Some plaques of silicosis are palpable in the pleurae. Right lung root glands are much enlarged, some are pigmented and fibrosed. Others are soft and infiltrated by tumour.

LUNGS. Section of the lungs shows slight excess of pigment aggregated in discrete islets which project slightly above the cut surface. A few nodules of tumour are present on the surface in the substance of the lung.

SECTION of the lining reveals extensive infiltration of tumour from the roots inwards, involving both the right lower and upper lobes. A purulent bronchitis is present.

Metastases are present in both suprarenals and in the right kidney.

C A S E 30.

AGE: 50 years.

UNDERGROUND SERVICE: 24 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (One month before death). Haemoptysis on several occasions. Nothing definite on physical examination.

RADIOLOGICAL REPORT: (One month before death). Generalised fibrosis. There is an opacity in the upper zone of the left lung which has been noted for the past 3 years. The appearances are those of a primary lung carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged - densely pigmented and densely fibrosed.

PLEURAE show the presence of extensive plaque formation.

LUNGS on section show a moderate increase in pigment aggregated in discrete islets, a few of which are palpable in both lungs and in one or two massive areas of tuberculo-silicosis. No overt tuberculosis. Left lung shows the presence of a large cavity in the upper lobe with bronchiectasis and septic pneumonia in the basal lobe.

MICROSCOPIC SECTIONS show the presence of a squamous carcinoma.

C A S E 31.

AGE: 47 years.

UNDERGROUND SERVICE: 9 years.

MAIN FEATURES OF CLINICAL EXAMINATION (8 months before death). Very short of breath. Coughing up dark yellow sputa. Nothing abnormal detected on physical examination.

RADIOLOGICAL REPORT: (8 months before death). There is a generalised fibrosis with silicotic mottling in both lung fields. There is no other evidence of any chest pathology.

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged. Slightly pigmented, extensively infiltrated by tumour.

PLEURAE shows patchy thickening, incipient plaque formation and adhesions in the apices.

LUNGS Section of the lungs shows increase in pigment aggregated in moderately numerous small to large islets of silicotic character. No overt tuberculosis.

Left lung shows primary bronchial carcinoma with two nodules of metastases in the left lung.

C A S E 32.

AGE: 71 years.

UNDERGROUND SERVICE: 43 years.

MAIN FEATURES OF CLINICAL EXAMINATION (2 months before death). Sputa blood streaked. Very short of breath. Sputum negative for tuberculosis.

RADIOLOGICAL REPORT: (2 months before death). There is generalised fibrosis. There is an opacity in the upper third of the right lung field. This opacity has been noted for the last 3 years and the appearances are those of a primary carcinoma of the lung.

POST-MORTEM REPORTS:

ROOT GLANDS are moderately enlarged and deeply pigmented and some are fibrosed.

PLEURAE deeply pigmented and show many palpable plaques.

SECTION OF LUNGS shows a moderate increase in pigment aggregated in discrete islets a few of which are palpable. There is no overt tuberculosis. Primary bronchogenic carcinoma is present in the right sub-apical region. Lungs are congested.

MICROSCOPIC SECTION of the lung growth shows the structure of a squamous carcinoma.

C A S E 33.

AGE: 77 years.

UNDERGROUND SERVICE: 9 years.

MAIN FEATURES OF CLINICAL EXAMINATION (3 years before death). Slight dyspnoea. Weighs 131 pounds and has lost 12 pounds in the past year.

RADIOLOGICAL REPORT (3 years before death). No evidence of any chest pathology.

POST-MORTEM REPORT:

RIGHT LUNG: 800 gms. LEFT LUNG: 670 gms. HEART: 350 gms.

ROOT GLANDS are moderately enlarged and moderately pigmented but are not fibrosed. Some on the right side are infiltrated by tumour.

PLEURAE are deeply pigmented but show no definite palpable plaques.

LUNGS on section show a slight increase in pigment but no evidence of silicosis. There is no overt tuberculosis in the lung substance. A large bronchogenic carcinoma is present at the right apex. There is slight chronic bronchitis. Secondary carcinoma is present in the left lung.

HEART is not enlarged.

MICROSCOPIC SECTION confirms the presence of a bronchogenic squamous carcinoma.

C A S E 34.

AGE: 67 years.

UNDERGROUND SERVICE: 26 years.

MAIN FEATURES OF CLINICAL EXAMINATION. (One year before death). Dry cough. Is very short of breath. Nothing abnormal detected on physical examination.

RADIOLOGICAL REPORT: (One year before death). There is a generalised fibrosis but no other evidence of pathology.

POST-MORTEM REPORT:

LUNGS not weighed: Fragments received. HEART 600 grams.

ROOT GLANDS are slightly enlarged and deeply pigmented and some are fibrosed.

PLEURAE are moderately pigmented but show no palpable plaques. They are largely obscured by chronic pleurisy.

LUNGS on section show a moderate increase in pigment aggregated in discrete islets, an occasional one of which is palpable. There is no overt tuberculosis in the lung substance. Slight degree of chronic bronchitis. An early bronchogenic carcinoma is present at the right hilum.

HEART is enlarged and shows a malignant pericarditis.

MICROSCOPIC SECTIONS of this lung tissue show the presence of a bronchogenic spheroidal celled carcinoma.

C A S E 35.

AGE: 66 years.

UNDERGROUND SERVICE: 23 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (5 months before death) Does not complain of any disability. Weighs 216 pounds and has put on 2 pounds in weight since his last examination one year ago. Sputum is negative for tuberculosis.

RADIOLOGICAL REPORT: (5 months before death) There is some fibrosis but no evidence of any mottling. There is an enlargement of the right hilar region suggesting a primary bronchial carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are enlarged, pigmented and fibrosed. One or two show tumour infiltration.

PLEURAE show numerous tags of fibrous adhesions. There is pigmentation but no significant plaque formation.

LUNGS. Sections of the lungs show moderate pigmentation but no evidence of silicosis or overt tuberculosis. There is a well marked chronic bronchitis and emphysema. The lungs are congested and oedematous. At the root of the right lung there is carcinomatous infiltration.

HEART is enlarged - coronary vessels show atheroma. Heart muscle is atrophic and fibrous.

C A S E 36.

AGE: 43 years.

UNDERGROUND SERVICE: 24 years.

MAIN FEATURES OF CLINICAL EXAMINATION (2 months before death). Very slightly short of breath. Slight cough associated with clear watery sputa. Sputum negative for tuberculosis.

RADIOLOGICAL REPORT: (2 months before death). There is some generalised fibrosis with an opacity in the right mid zone suggestive of a primary bronchial carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged, moderately pigmented densely fibrosed and some show foci of calcification. There is well marked chronic periadenitis.

PLEURAE show moderate pigmentation with moderately numerous small palpable plaques and scars. Tags of adhesions are present.

LUNGS. Section of the lung shows moderate pigmentation but no evidence of silicosis or tuberculosis. There is a well marked chronic bronchitis and emphysema. At the root of the right lung is a carcinoma. In the right apical lobe is pneumonic consolidation.

HEART shows atrophy.

MICROSCOPIC SECTION of this growth shows the structure of a squamous carcinoma of bronchial origin.

C A S E 37.

AGE: 45 years.

UNDERGROUND SERVICE: 20 years.

MAIN FEATURES OF CLINICAL EXAMINATION (2 months before death). Has lost 40 pounds in the last 6 months. Urine normal. Sputa positive for tuberculosis. Has a bad cough and has been ill in bed for the last 6 months. Marked oedema of the legs. Pulse 116. Clinical diagnosis "Pulmonary Tuberculosis."

RADIOLOGICAL REPORT: (2 months before death).

There is a generalised fibrosis with silicotic mottling in both lung fields. There is an opacity in the upper zone of the left lung field and the appearances are those of "Pulmonary Tuberculosis."

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged, moderately pigmented and moderately fibrosed. On the left they are infiltrated by tumour. There is a well marked chronic periadenitis.

PLEURAE. There are dense adhesions over the left lung. Right pleura shows moderate pigmentation with sparse irregular palpable plaques. At the apex there is scarring.

LUNGS. Section of the lung shows moderate pigmentation

with sparse palpable irregular islets situated mainly in the apical lobes. In the left apex there are chronic tuberculous cavities filled with pus. In the left bronchus is a carcinoma obliterating the lumen. In the right basal lobe is a septic broncho-pneumonia. Well marked bronchitis and emphysema is present.

HEART. The right side is dilated.

MICROSCOPIC SECTIONS of this tumour of the bronchus show the structure of a squamous carcinoma. Section of the lung shows active tuberculosis.

C A S E 38.

AGE: 57 years.

UNDERGROUND SERVICE: 24 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (5 months before death) Weighs 124 pounds and has lost 14 pounds in the last 6 months. Is very short of breath and is coughing up a blood streaked sputum. The urine shows a trace of albumen and the sputum is negative for tuberculosis.

RADIOLOGICAL REPORT: (5 months before death). There is a generalised fibrosis with an opacity in the left mid zone which has been present for the past 2 years. The appearances indicate a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged and deeply pigmented and some are fibrosed. Some are infiltrated by carcinoma.

PLEURAE are deeply pigmented and show many palpable plaques.

LUNGS ON SECTION show a moderate increase - pigment aggregated in discrete islets a few of which are palpable. There is no overt tuberculosis. Primary

bronchogenic carcinoma is present in the left main bronchus with secondary bronchial obstruction, bronchiectasis and broncho-pneumonia.

HEART shows atrophy.

MICROSCOPIC SECTION of this bronchogenic growth shows the structure of a spheroidal celled carcinoma.

C A S E 39.

AGE: 62 years.

UNDERGROUND SERVICE: 30 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (11 months before death). Repeated haemoptysis and is very dyspnoeic.

RADIOLOGICAL REPORT: (11 months before death). There is a generalised fibrosis with enlargement of the left hilar shadow suggesting a primary bronchial carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged and deeply pigmented. Some are tuberculo-silicotic.

PLEURAE are moderately pigmented and show the presence of some palpable plaques particularly on the right side. Tags of fibrous adhesions are present in the left.

LUNGS. On section show a moderate increase in pigment aggregated in discrete islets, one or two of which are palpable in the apex of the left lung. There is no overt tuberculosis. Bronchitis and bronchopneumonic consolidation is present in both lungs. Bronchogenic carcinoma is present in the root area and apex of the left lung.

HEART. Coronary vessels show no pathological change.

MICROSCOPIC SECTIONS of the lung tissue and bronchus show the presence of a bronchogenic squamous carcinoma.

C A S E 40.

AGE: 59 years.

UNDERGROUND SERVICE: 8 years.

MAIN FEATURES OF CLINICAL EXAMINATION (3 years before death). Has a cough and brings up yellow sputum. Is very short of breath.

RADIOLOGICAL REPORT: (3 years before death). Has a generalised fibrosis but no other evidence of pathology.

POST-MORTEM REPORT:

ROOT GLANDS much enlarged, deeply pigmented and densely fibrosed. There is a moderate degree of chronic periadenitis.

PLEURAE shows marked increase in pigment and a few plaques are palpable. On the left side a marked chronic pleurisy is present.

LUNGS. On section show a moderate increase in pigment aggregated in medium sized discrete islets, a few of which are palpable in the apical lobes. There is no overt tuberculosis. On the left side is a carcinoma of the left bronchus which has caused stenosis of the air passage. As a result of the stenosis of the bronchus the left lung is the seat of an organising septic broncho-pneumonia and of marked bronchiectasis. Very marked bronchiectasis

(chronic) is present in both lungs. The right lung shows marginal emphysema.

MICROSCOPIC SECTIONS of this growth of the left bronchus show the structure of a squamous carcinoma.

C A S E 41.

AGE: 56 years.

UNDERGROUND SERVICE: 25 years.

MAIN FEATURES OF CLINICAL EXAMINATION. (6 months before death). Very short of breath. Sputum is blood streaked and has had a frank haemoptysis on two occasions.

RADIOLOGICAL REPORT: (3 months before death). There is a fair amount of generalised fibrosis with an opacity of the lower third of the right lung field. Bronchogram shows a complete block of the descending branch of the right bronchus. There is some atelectasis of the right lower lobe with the heart and trachea pulled over to the right side. The appearances are those of a primary bronchial carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS on the right side are much enlarged, moderately pigmented and slightly fibrosed. There is a moderate degree of chronic peri-adenitis.

PLEURAE over the right lung shows patchy thickening. There is moderate pigmentation but no plaque formation. There is slight scarring at the apices.

LUNGS. Section of the lung shows moderate pigmentation with a very occasional palpable small islet. In the

right basal lobe is a primary carcinoma of the lung.
There is septic broncho-pneumonia in both lungs.
Well marked bronchitis.

HEART. Well marked atheroma of the coronary vessels.

MICROSCOPIC SECTION shows the structure of a squamous carcinoma.

C A S E 42.

AGE: 59 years.

UNDERGROUND SERVICE: 27 years.

MAIN FEATURES OF CLINICAL EXAMINATION. (3 months before death). Weighs 157 pounds and has lost 8 pounds in the past year. Sputum negative for tuberculosis.

RADIOLOGICAL REPORT: (3 months before death). There is generalised fibrosis with silicotic mottling in both lung fields. For the past 10 months has had an opacity in the left mid zone suggesting a primary bronchial carcinoma in this region.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged and deeply pigmented. Some are densely fibrosed. Some show infiltration by a malignant neoplasm.

PLEURAE show a moderate increase in pigment and the presence of one or two palpable plaques. Fibrous adhesions are present on the left side.

LUNGS. On section show a moderate increase in pigment aggregated in discrete islets, one or two of which are just palpable. There is no overt tuberculosis.

Broncho-pneumonic consolidation, emphysema and bronchitis are present in both lungs. A bronchogenic carcinoma is present in the left hilar region.

MICROSCOPIC SECTIONS of this lung tissue show the presence of foci of tuberculo-silicosis and broncho-genic adeno-carcinoma.

C A S E 43.

AGE: 60 years.

UNDERGROUND SERVICE: 43 years.

MAIN FEATURES OF CLINICAL EXAMINATION (one month before death). Coughing up dark yellow sputum with an occasional haemoptysis. Is very short of breath. Complains of tenderness over the right hypochondrium.

RADIOLOGICAL REPORT: (One month before death). There is a generalised small silicotic mottling in both lung fields. There is an opacity in the upper zone of the right lung field which has been noted for 27 months and whose appearances suggest a primary bronchial carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are moderately pigmented, moderately enlarged, densely fibrosed and show calcification.

PLEURAE. Over the right lung there is diffuse thickening and scarring, particularly over the apical lobe.

LUNGS. On section show moderate pigmentation with irregular palpable islets and small massive areas of fibrosis situated mainly in the apical lobes. In the right lung there is a large primary carcinoma in the apical lobe and an extensive suppurative pneumonia

in the basal lobe.

HEART is small and atrophic. Vessels are atheromatous.

MICROSCOPIC SECTIONS of the lung show the presence of bronchogenic spheroidal celled carcinoma.

C A S E 44.

AGE: 56 years.

UNDERGROUND SERVICE: 7 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (9 months before death). Weighs 147 pounds and has lost 9 pounds in the past year. Is very dyspnoeic and coughs up a blood streaked sputum.

RADIOLOGICAL REPORT: (9 months before death).

There is no evidence of silicosis. There is an opacity in the right upper third, suggesting a primary carcinoma. Radiological examination 4 years before death showed a bronchiectasis of the right base of the lung.

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged and the right side are soft from acute infection.

PLEURAE show abundant fibrinous exudate over the right lung. Occasional plaque formation and scarring, particularly at the left apex.

LUNGS. On section show moderate pigmentation but no definite evidence of silicosis. In the right apical lobe is a large cavity containing blood and blood clot and lined by a thick capsule which suggests tumour. In the right basal lobe are numerous bronch-

iectatic abscesses.

HEART is small and atrophic. Vessels are sclerotic.

MICROSCOPIC SECTIONS of this lung tissue show the presence of squamous carcinoma and septic broncho-pneumonia.

C A S E 45.

AGE: 72 years.

UNDERGROUND SERVICE: 29 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (1 month before death). Weighs 112 pounds and has lost 7 pounds in the last year. Has had one haemoptysis. Is very short of breath.

RADIOLOGICAL REPORT: (1 month before death). There is no evidence of silicosis. For the last 7 months an opacity has been noted in the left upper zone with appearances suggestive of a primary bronchial carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are pigmented but not fibrosed.

PLEURAE show moderate pigmentation but no plaque formation. There is slight scarring on the apices and dense adhesions over the apical lobe of the left lung.

LUNGS. On section show moderate pigmentation but no evidence of silicosis. In the left apical lobe is a large cavity surrounded by dense whitish infiltration suggestive of tumour. In the left bronchus is tumour infiltration. There is no overt tuberculosis. Well marked chronic bronchitis is present. In the right lung there is emphysema.

HEART. Coronary vessels show trace of atheroma.

MICROSCOPIC SECTION shows squamous carcinoma of bronchial origin.

C A S E 46.

AGE: 45 years.

UNDERGROUND SERVICE: 20 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (4 months before death). Dry cough. Very short of breath. Is not losing any weight.

RADIOLOGICAL REPORT: (4 months before death). There is no evidence of silicosis and no evidence of any lung pathology.

POST-MORTEM REPORT:

ROOT GLANDS much enlarged, moderately pigmented and moderately fibrosed. They show extensive tumour infiltration.

PLEURAE. Over the right lung is an abundant fibrinous exudate, particularly over the basal lobe. Left pleura shows moderate increase in pigment with some irregular patchy thickening over the apical lobe.

LUNGS. Section of lungs shows moderate increase in pigment. No evidence of silicosis. No overt tuberculosis. In the right bronchus is a carcinoma with infiltration of the apical lobe. In the basal lobe is a septic broncho-pneumonia. There is well marked bronchitis.

HEART shows an acute pericarditis. There is moderate atheroma with calcifying coronary vessels.

MICROSCOPIC SECTIONS show the structure of primary bronchial carcinoma.

C A S E 47.

AGE: 55 years.

UNDERGROUND SERVICE: 20 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (10 months before death). Has a dry cough. Weighs 170 pounds and has put on 6 pounds during the last year.

RADIOLOGICAL REPORT: (10 months before death). There is a generalised fibrosis with silicotic mottling in both lung fields. There is an opacity of the left lung field due to a primary bronchial carcinoma.

N.B. This miner had "Deep X-ray Therapy" and this has resulted in a diminution in the size of the opacity and in a temporary improvement in the general health of this case.

POST-MORTEM REPORT:

ROOT GLANDS are enlarged and tuberculo-silicotic. On the left show tumour infiltration.

PLEURAE. On the left shows marked thickening due to tumour infiltration.

On the right chronic pleurisy is present.

LUNGS. Section of lung shows increase in pigment, aggregated in moderately numerous small to large islets and small areas of tuberculo-silicosis.

No overt tuberculosis. The left lung is the seat of extensive tumour infiltration and some of the areas of tuberculo-silicosis in the lower lobe are surrounded by tumour.

MICROSCOPIC SECTIONS show carcinoma of bronchial origin.

Metastases are present in the liver.

C A S E 48.

AGE: 78 years.

UNDERGROUND SERVICE: 45 years.

MAIN FEATURES OF CLINICAL EXAMINATION (3 months before death). Weighs 140 pounds. Has not lost any weight during the past year. Coughs up a dark yellow sputum. Is very dyspnoeic.

RADIOLOGICAL REPORT: (3 months before death). There is an opacity in the right mid zone suggestive of tuberculosis or a primary bronchial carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS slightly enlarged. Markedly pigmented and densely fibrosed. Moderate degree of chronic periadenitis is present.

PLEURAE shows moderately marked increase in pigment with moderately numerous medium sized plaques. In addition there are numerous flat tumour nodules of varying sizes over the surface of both lungs.

LUNGS. Section of the lung shows moderate increase in pigment with moderately numerous medium sized palpable islets irregularly distributed throughout the lungs. In the right apex is a small area of massive fibrosis. There is no overt tuberculosis. In the right lung, particularly the basal area there are several small tumour foci association with primary bronchial carcinoma in the right middle lobe. Moderate degree of

chronic bronchitis and emphysema.

HEART shows fatty infiltration. Coronary vessels show a moderate degree of atheroma.

MICROSCOPIC SECTIONS show a spheroidal cell carcinoma of bronchial origin.

C A S E 49.

AGE: 71 years.

UNDERGROUND SERVICE: 29 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (3 months before death). Weighs 155 pounds and has lost 3 pounds in the last 4 months. Is very short of breath. Sputum is negative for tuberculosis.

RADIOLOGICAL REPORT: (3 months before death). There is generalised fibrosis but no other evidence of lung pathology.

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged, deeply pigmented and many are fibrosed. There is slight chronic peri-adenitis. Deposits of malignant new growth are present in chains on either side extending from the thyroid gland to the lower part of the root areas.

PLEURAE show very marked degree of pigmentation. Many plaques are palpable and there is much scarring over the apical lobes.

LUNGS. On section show a moderate amount of pigment which is aggregated in discrete islets of which a few are palpable. There is no sign of active tuberculosis. At the base of the right lung is a puckered mass of malignant new growth. Chronic bronchitis is present.

MICROSCOPIC SECTIONS show primary carcinoma of the lung of squamous cell type. The glands are extensively involved. No evidence of tuberculosis in the sections examined.

C A S E 50.

AGE: 58 years.

UNDERGROUND SERVICE: 15 years.

MAIN FEATURES OF CLINICAL EXAMINATION. (18 months before death). Weighs 126 pounds. Has not lost any weight during the past year. Does not cough.

RADIOLOGICAL REPORT: (18 months before death). There is a generalised medium mottling of silicotic origin but no other evidence of pathology.

POST-MORTEM:

ROOT GLANDS on the right side are extensively infiltrated by tumour. On the left side there is a moderate increase in pigment and dense fibrosis.

PLEURAE. On the right side is the seat of extensive tumour infiltration with haemorrhage, on the left side there is moderate increase in pigment with the formation of numerous medium sized plaques. There is an adhesion at the apex.

LUNGS. Section of the lungs shows increase in pigment aggregated mainly in numerous medium sized palpable islets situated in the apical lobes. No overt tuberculosis. Left lung is collapsed. Right lung shows tumour infiltration, particularly in the basal

lobe. Well marked chronic bronchitis is present.

Heart is atrophic.

MICROSCOPIC SECTIONS of this growth show the structure of a carcinoma of the oat seed type.

C A S E 51.

AGE: 70 years.

UNDERGROUND SERVICE: 8 years.

MAIN FEATURES OF CLINICAL EXAMINATION (one year before death). Has only a slight cough. Is very short of breath. Weighs 130 pounds and has lost 3 pounds in the last year.

RADIOLOGICAL REPORT: (one year before death). There is generalised fibrosis. Heart is enlarged. No evidence of any pathology in the ribs.

POST-MORTEM REPORT:

RIGHT LUNG: 560 grams. LEFT LUNG 790 grams. HEART 320
grams.

ROOT GLANDS are moderately enlarged, moderately pigmented and densely fibrosed - on the left side they are infiltrated by tumour. There is a well marked chronic periadenitis.

PLEURAE show moderate pigmentation with moderately numerous irregular palpable plaques - at the left base is a fibrinous exudate.

LUNGS on section show slight to moderate pigmentation with a few palpable islets in the apical lobes. There is no overt tuberculosis. In the left lung is a primary carcinoma of the bronchus and an acute basal broncho pneumonia. There is well marked chronic bronchitis

and a moderate degree of emphysema.

HEART shows an acute bacterial endocarditis.

I am of opinion that there is a slight degree of silicosis in the lungs and that this was not a factor in the cause of death.

MICROSCOPIC SECTIONS of this growth of the lung show the structure of an adenocarcinoma.

Sections of the growth in the rib show the structure of an adenocarcinoma similar to that of the lung tumour.

C A S E 52.

AGE: 60 years.

UNDERGROUND SERVICE: 34 years.

MAIN FEATURES OF CLINICAL EXAMINATION (6 months before death). Weighs 113 pounds. Is very short of breath. Nothing abnormal noted in chest except bi-lateral rhonchi..

RADIOLOGICAL REPORT (6 months before death). There is a generalised fibrosis in both lung fields. There is an opacity in the right mid zone, which has been noted for the past 13 months and the appearances suggest a primary bronchogenic carcinoma.

POST-MORTEM REPORT :

RIGHT LUNG: 1150 grams. LEFT LUNG: 950 grams. HEART:
400 grams.

ROOT GLANDS are moderately enlarged and deeply pigmented and some are fibrosed.

PLEURAE are deeply pigmented and show one or two palpable plaques. Chronic pleurisy is present on the right side. Apical scarring on both sides.

LUNGS On section show a moderate increase in pigment aggregated in discrete islets, an occasional one of which is palpable. Lungs are congested and markedly oedematous. There is no overt tuberculosis in the lung

substance. Large cavity is present in basal part of the right apical lobe.

HEART is not enlarged.

MICROSCOPIC SECTIONS of the apical lobe cavity wall show infiltration by spheroidal celled carcinoma.

C A S E 53.

AGE: 68 years.

UNDERGROUND SERVICE: 32 years.

MAIN FEATURES OF CLINICAL EXAMINATION (4 months before death). Weighs 136 pounds and has put on 3 pounds during the last 4 months. Is very short of breath and coughs up a dark yellow sputum.

RADIOLOGICAL REPORT: (4 months before death). There is a generalised fibrosis with silicotic mottling in both lung fields. An opacity is shown in the left mid zone and the appearances suggest a primary carcinoma of the left lung.

POST-MORTEM REPORT:

RIGHT LUNG: 550 grams. LEFT LUNG: 950 grams.

ROOT GLANDS are moderately enlarged, deeply pigmented and some are fibrosed. Some on the left side are infiltrated with tumour.

PLEURAE are moderately pigmented and show a moderate number of palpable plaques.

LUNGS On section show a marked increase in pigment aggregated in discrete islets, a moderate number of which are palpable. There is no overt tuberculosis in the lung substance. A large bronchogenic carcinoma is present at the left hilum. Sections will be cut to determine the nature of the growth.

HEART was not received.

I am of opinion that there is a moderate degree of silicosis which was not a factor in the cause of death.

MICROSCOPIC SECTIONS of this lung show the structure of a squamous carcinoma.

C A S E 54.

AGE: 62 years.

UNDERGROUND SERVICE: 7 years.

MAIN FEATURES OF CLINICAL EXAMINATION (6 months before death). Had pleurisy on the left side some years ago. Is very dyspnoeic. Coughs up a dark yellow sputum.

RADIOLOGICAL REPORT: (6 months before death). There is a generalised fibrosis with silicotic mottling in both lung fields. A pleural effusion is present on the left side, but as the heart and mediastinum are pulled over to the left an underlying atelectasis is suggested.

POST-MORTEM REPORT:

RIGHT LUNG: 770 grams. LEFT LUNG: 790 grams: Heart 370 grams.

ROOT GLANDS are slightly enlarged and deeply pigmented and densely fibrosed.

PLEURAE are deeply pigmented and show an occasional palpable plaque. Chronic pleurisy is present on the right side and fibrinous pleurisy on the left.

LUNGS. On section show a moderate increase in pigment aggregated in discrete islets a moderate number of which are palpable. Left lung shows septic broncho-pneumonia with a necrotic bronchogenic carcinoma.

There is no overt tuberculosis in the lung substance.

HEART is not enlarged.

OPINION: There is a slight to moderate degree of silicosis which was not a factor in the cause of death.

MICROSCOPIC SECTIONS of left lung growth show the structure of a spheroidal celled carcinoma.

C A S E 55.

AGE: 59 years.

UNDERGROUND SERVICE: 24 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (11 months before death). Weighs 173 pounds and has lost 5 pounds in the last 6 months. Nothing abnormal noted on physical examination.

RADIOLOGICAL REPORT: (11 months before death). There is no evidence of fibrosis. An opacity is present in the right mid zone and the appearances suggest a primary carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG: 830 grams. LEFT LUNG: 650 gms. HEART: 370 grams.

ROOT GLANDS on the right side are grossly enlarged. Some are moderately pigmented but are not fibrosed. They are markedly infiltrated by malignant neoplasm. Glands on the left side are moderately enlarged and deeply pigmented but are not fibrosed.

PLEURAE are moderately pigmented and show one or two palpable plaques. The right pleura shows infiltration by malignant neoplasm.

LUNGS on section show moderate increase in pigment aggregated in discrete islets; one or two of which are

palpable. There is no overt tuberculosis. Carcinoma is present in the right lung and there is an associated bronchopneumonic consolidation.

HEART shows no significant pathological change.

MICROSCOPIC SECTIONS of this lung tissue and hilar root gland show the present of oat cell carcinoma.

C A S E 56.

AGE: 71 years.

UNDERGROUND SERVICE: 14 years.

MAIN FEATURES OF CLINICAL EXAMINATION (6 months before death). Coughing up sputa which resembles red currant jelly. Is very short of breath.

RADIOLOGICAL REPORT: (6 months before death). There is a generalised fibrosis. An opacity is present in the left mid zone and this was first noted 7 months ago. The appearances suggest a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG: 630 gms. LEFT LUNG: 1110 gms. HEART: 530 gms.

ROOT GLANDS are moderately enlarged, moderately pigmented and fibrosed - on the left side they are infiltrated by carcinoma.

PLEURAE show moderate pigmentation but no plaque formation. Over the left upper lobe there is carcinomatous infiltration.

LUNGS. On section show moderate pigmentation but no evidence of silicosis or of overt tuberculosis. In the left apical lobe there is extensive carcinomatous infiltration. In the basal lobe there is broncho-

pneumonic consolidation. Right lung shows chronic bronchitis, emphysema and congestion.

HEART shows extensive infiltration of pericardium by carcinoma.

MICROSCOPIC SECTIONS of this growth of the lung show the structure of a squamous carcinoma of bronchial origin.

C A S E 57.

AGE: 68 years.

UNDERGROUND SERVICE: 13 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (one year before death). Coughing up dark yellow sputa. Is very dyspnoeic.

RADIOLOGICAL REPORT: (one year before death). No evidence of any fibrosis or other lung pathology.

POST-MORTEM REPORT:

RIGHT LUNG: 430 gms. LEFT LUNG: 510 gms. HEART: 340 gms..

ROOT GLANDS are moderately enlarged and deeply pigmented. Some are partially fibrosed.

PLEURAE are moderately pigmented but show no definite plaque formation.

LUNGS. On section show a moderate increase in pigment aggregated in discrete islets one or two of which are palpable. There is no overt tuberculosis. An area of consolidation, sections of which are being cut, is present in the right upper lobe and shows central necrosis and cavity formation. Chronic bronchitis, hypostatic congestion and marked emphysema are present in both lungs.

HEART The coronary vessels show some atheromatous

change but no point of occlusion has been observed.

The cardiac muscle shows marked softening.

MICROSCOPIC SECTIONS of this tissue from the right lung show the presence of spheroidal celled bronchogenic carcinoma.

C A S E 58.

AGE: 59 years.

UNDERGROUND SERVICE: 22 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (3 months before death). Weighs 160 pounds and has lost 20 pounds in the last year. Physical examination indicates a pleural effusion on the right side.

RADIOLOGICAL REPORT: (3 months before death). There is a generalised fibrosis with sillicotic mottling in both lung fields. There is an opacity over the whole of the right lung field due to a pleural effusion.

POST-MORTEM REPORT:

RIGHT LUNG: 1470 gms. LEFT LUNG: 930 gms. HEART 470 gms.

ROOT GLANDS are much enlarged, moderately pigmented and densely fibrosed. Some show calcification. There is a well-marked chronic periadenitis.

PLEURAE. There are adhesions over both lungs and much irregular thickening of pleura on the right side.

LUNGS. Section of the lungs show moderate pigmentation but only a very occasional small islet is palpable. There is no overt tuberculosis. In the right basal lobe is an extensive infiltrating carcinoma with septic pneumonia and abscess formation. There is well-marked chronic bronchitis and emphysema.

HEART shows recent pericarditis. Right side is dilated.

MICROSCOPIC SECTIONS of this tissue from the right lung show the presence of spheroidal celled bronchogenic carcinoma.

C A S E 59.

AGE: 61 years.

UNDERGROUND SERVICE: 17 years.

MAIN FEATURES OF CLINICAL EXAMINATION (5 years before death). Is very short of breath. Has a dry cough. Nothing abnormal to note on physical examination.

RADIOLOGICAL REPORT: (5 years before death). There is a generalised fibrosis with silicotic mottling in both lung fields.

POST-MORTEM REPORT:

RIGHT LUNG: 900 gms. LEFT LUNG: 840 gms. HEART 430 gms.

ROOT GLANDS are moderately enlarged and deeply pigmented. Some are fibrosed.

PLEURAE are deeply pigmented but show no definite palpable plaques. They are largely obscured by fibrous thickening on the left side and fibrinous exudate on the right.

LUNGS on section show a marked increase in pigment aggregated in discrete islets, a moderate number of which are palpable. There is no overt tuberculosis. Primary bronchogenic carcinoma is present in the left lung. Hypostatic pneumonia is present at both bases.

HEART is moderately enlarged and shows atheroma of the coronaries.

MICROSCOPIC SECTIONS of this lung show the presence of bronchogenic squamous carcinoma.

C A S E 60.

AGE: 68 years.

UNDERGROUND SERVICE: 38 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (6 months before death). Haematuria due to a pyelo-nephritis. No cough. Is short of breath.

RADIOLOGICAL REPORT: (5 months before death). There is a generalised fibrosis with silicotic mottling in both lung fields. No other evidence of pathology in the chest.

POST-MORTEM REPORT:

RIGHT LUNG: 580 gms. LEFT LUNG: 500 gms. HEART 260 gms.

ROOT GLANDS are moderately enlarged, deeply pigmented and densely fibrosed.

PLEURAE are markedly pigmented and show one or two palpable plaques.

LUNGS. On section show a moderate to marked increase in pigment but no evidence of silicosis. There is no overt tuberculosis. One or two small foci suggestive of neoplasm are present in the substance of the right lung.

HEART is small and atrophic and shows the presence of endocarditis. The coronary vessels show

atheroma and sclerosis.

MICROSCOPIC SECTIONS of this lung tissue show the presence of a squamous carcinoma.

C A S E 61.

AGE: 35 years.

UNDERGROUND SERVICE: 18 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (2 months before death). Weighs 133 pounds and has lost 9 pounds in the last two months and 18 pounds in the last year. Has had repeated haemoptysis. Physical signs show that the percussion note is dull over the left upper zone with diminished breath sounds over the same area. On auscultation rhonchi are heard over both lungs.

RADIOLOGICAL REPORT: (6 months before death). There is no evidence of any silicosis. For the past year there has been an opacity in the left hilar region and a bronchogram done at the Germiston Hospital confirms the presence of a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, moderately pigmented and moderately fibrosed. On the left side they are infiltrated with tumour.

PLEURAE show moderate pigmentation but no plaque formation. On the left side there is an extensive malignant infiltration with malignant pleurisy. On the left side there is much thickening of the pleurae.

LUNGS. The right lung shows slight to moderate pig-

mentation but no evidence of silicosis. There is no overt tuberculosis. Lung is oedematous and congested. The left lung shows moderate pigmentation with no palpable nodules. There is an extensive tumour formation in the apical lobe with cavity formation. There is also diffuse infiltration of the basal lobe and some broncho-pneumonia. There is marked bronchitis.

HEART is small -(atrophied.)

MICROSCOPIC SECTIONS show a primary bronchogenic carcinoma.

C A S E 62.

AGE: 49 years.

UNDERGROUND SERVICE: 6 years.

MAIN FEATURES OF CLINICAL EXAMINATION (3 months before death). Has a dry cough. Is very short of breath. Sputum negative for tuberculosis.

RADIOLOGICAL REPORT: (3 months before death). There is a generalised fibrosis with silicotic mottling in both lung fields. There is an opacity in the upper third of the right lung field which may either be due to tuberculosis or to a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG: 1270 gms. LEFT LUNG: 430 gms. HEART 360 gms.

ROOT GLANDS are much enlarged, moderately pigmented and densely fibrosed and infiltrated by tumour, particularly on the right side.

PLEURAE show moderate pigmentation with irregular plaque formation and patchy thickening. Adhesions are present.

LUNGS. Section of the lungs show moderate pigmentation with moderately numerous medium-sized palpable islets situated mainly in the apical lobes. In the right lung is a primary carcinoma of the bronchus with diffuse infiltration into the lung substance. There is no overt tuberculosis. There is well marked chronic

bronchitis and emphysema.

HEART Coronary vessels show traces of atheroma.

MICROSCOPIC SECTIONS of this lung show the presence of a bronchogenic squamous carcinoma.

C A S E 63.

AGE: 65 years.

UNDERGROUND SERVICE: 17 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (7 months before death). Weighs 163 pounds. Has lost 32 pounds in 13 months. Has dry cough. Is very short of breath. On physical examination the breath sounds over the upper third of the right lung are bronchovesicular.

RADIOLOGICAL REPORT: (7 months before death). There is generalised fibrosis. An opacity is present in the right upper zone and the appearances suggest a primary bronchial carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged, moderately pigmented and densely fibrosed. Some show extensive tumour infiltration, especially the glands on the right side. There is a well marked chronic periadenitis.

PLEURAE show moderate pigmentation with occasional plaque formation. There are adhesions and over the right apical lobe is extensive carcinomatous infiltration.

LUNGS. Section of the lungs shows moderate pigmentation with an occasional palpable small islet. There

is no overt tuberculosis. In the right apical lobe is extensive tumour infiltration originating from the right bronchus. An occasional metastatic nodule is present in the left lung. There is well marked chronic bronchitis but no emphysema.

HEART. Coronary vessels show sclerosis and atheroma. Right side is hypertrophied and dilated.

C A S E 64.

This miner was seen for the first time 17 years before his death and did not report again to the Bureau. His lungs were sent in for examination when he died at the age of 35 years.

RADIOLOGICAL REPORT: (17 years before death). Normal Thorax.

POST-MORTEM REPORT:

RIGHT LUNG: 520 gms. LEFT LUNG: 510 gms.

ROOT GLANDS are not enlarged but are deeply pigmented and slightly fibrosed.

PLEURAE are slightly pigmented and show no evidence of plaque formation.

LUNGS. On section show a slight increase in pigment but no evidence of silicosis. There is no overt tuberculosis. A primary bronchogenic carcinoma is present in the left lung.

MICROSCOPIC SECTIONS of the left lung show the presence of an oat cell carcinoma.

C A S E 65.

This miner was seen for the first time 28 years before his death and did not report again to the Silicosis Medical Bureau. He died at the age of 48 years and his lungs were sent in for examination.

RADIOLOGICAL REPORT (28 years before death) Normal Thorax.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, moderately pigmented and some are fibrosed.

PLEURAE are markedly pigmented and show the presence of a few palpable plaques.

LUNGS. On section show a moderate increase in pigment aggregated in discrete islets a few of which are palpable. There is no overt tuberculosis. The right lung shows evidence of bronchogenic carcinoma.

MICROSCOPIC SECTIONS of the right lung show evidence of bronchogenic carcinoma.

C A S E 66.

AGE: 65 years.

UNDERGROUND SERVICE: 7 years.

MAIN FEATURES OF CLINICAL EXAMINATION; (10 months before death). Weighs 172 pounds and has put on 12 pounds in the last year. Is very short of breath and coughs up a blood streaked sputum.

RADIOLOGICAL REPORT: (10 months before death) There is no evidence of silicosis. An opacity is present in the middle third of the right lung field and the appearances suggest a primary bronchial carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged, pigmented and infiltrated by tumour, some are pigmented and fibrosed, some show calcification.

PLEURAE show moderate pigmentation with sparse palpable plaques and scars.

LUNGS. Section of the right lung shows moderate pigmentation but no silicosis. In the right lung is a bronchial carcinoma affecting the bronchus to the basal lobe. Section of the left lung shows pigmentation. There is no overt tuberculosis. There is well marked chronic bronchitis and emphysema.

HEART shows tumour infiltration. There are metastases

in the heart, liver and suprarenals.

MICROSCOPIC SECTIONS of lung, lymph nodes, heart wall and suprarenals show the presence of oat cell carcinoma of bronchial origin.

C A S E 67.

AGE: 50 years.

UNDERGROUND SERVICE: 10 years.

MAIN FEATURES OF CLINICAL EXAMINATION (one month before death). Is not losing weight and has actually gained one pound since his last examination. Is very short of breath and is coughing up a dark yellow sputum. The sputum is negative for tuberculosis and has been repeatedly examined for the past 7 years.

RADIOLOGICAL REPORT: (one month before death) There is no evidence of silicosis. There is an opacity in the upper third of the right lung field which is suggestive of tuberculosis and this opacity has been present for 7 years.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, moderately pigmented, slightly fibrosed and infiltrated with tumour.

PLEURAE. There are dense adhesions with irregular patchy thickening of the pleurae in the apical lobes. There is slight increase in pigment but no definite plaque formation.

LUNGS. Section of the lungs show slight increase in pigment but no evidence of silicosis. A carcinoma is present in the right bronchus and this is infiltrating

the lung substance. There are nodules of carcinoma throughout the right apical lobe and one or two in the basal lobe. In the right apical lobe is a septic bronchopneumonia with commencing cavity formation. Well marked bronchitis is present.

MICROSCOPIC SECTION. Section of the right lung shows the presence of bronchial carcinoma of squamous type and active tuberculosis with septic bronchopneumonia.

C A S E 68.

AGE: 61 years.

UNDERGROUND SERVICE: 9 years.

MAIN FEATURES OF CLINICAL EXAMINATION. (3 months before death). Coughing up dark yellow sputa. Is very short of breath. Wasserman reaction is negative and the sputum is negative for tuberculosis.

RADIOLOGICAL REPORT: (3 months before death). There is a generalised fibrosis. An opacity is present in the lower third of the right lung and the appearances suggest a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are enlarged, pigmented and fibrosed. One at the root of the Right lung shows calcareous foci.

PLEURAE. There are adhesions over the apices of both lungs. Pleurae show increase in pigment with the formation of an occasional plaque.

SECTIONS OF THE LUNGS show increase in pigment aggregated in moderately numerous small to medium sized islets, an occasional one of which is palpable. In the lower lobe of the right lung is a carcinomatous mass arising from a branch of the bronchus to the right lower lobe.

C A S E 69.

AGE: 54 years.

UNDERGROUND SERVICE: 5 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (3 months before death). Weighs 113 pounds and has put on one pound in the past year. Haemoptysis present on two occasions, though sputum now is always blood streaked. On physical examination occasional rhonchi are heard on auscultation.

RADIOLOGICAL REPORT: (3 months before death). There is no evidence of silicosis. An opacity is present in the upper third of the left lung field and this is either due to tuberculosis or to a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are moderately pigmented and slightly fibrosed. There is a moderate degree of chronic periadenitis.

PLEURAE show moderate increase in pigment but no plaque formation. There is scarring and patchy thickening over the apical lobes.

LUNGS. Section of the lung shows moderate increase in pigment but no evidence of silicosis. There is no overt tuberculosis. There is a marked chronic bron-

chitis and emphysema. In the left upper bronchus is a small area suggestive of carcinoma. In the right basal lobe is a septic bronchopneumonia with abscess formation.

HEART shows dilatation of the right ventricle.

MICROSCOPIC SECTIONS of the growth in the lung shows the structure of an adenocarcinoma.

C A S E 70.

AGE: 66 years.

UNDERGROUND SERVICE: 22 years.

MAIN FEATURES OF CLINICAL EXAMINATION (2 months before death). Dry cough which does not worry him very much. Is very short of breath. Weighs 129 pounds and has lost 4 pounds in the last year.

RADIOLOGICAL REPORT: (2 months before death). There is a generalised fibrosis but no other evidence of lung pathology. Heart is enlarged.

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged, moderately pigmented and densely fibrosed. Some show calcification. On the left side is an extensive infiltration by tumour. There is a much marked chronic periadenitis.

PLEURAE show moderate pigmentation with sparse irregular plaque formation, there is moderate scarring at the apices and tags of fibrous adhesions are present.

LUNGS. Section of the lungs shows moderate pigmentation with moderately numerous irregular palpable islets situated mainly in the apical lobes. No overt tuberculosis. In the left basal lobe is a carcinoma of the bronchus with infiltration of the lung substance and metastatic nodules. There is well marked chronic

bronchitis and emphysema. The basal lobes are congested and show consolidation.

HEART is much enlarged with hypertrophy of the left ventricle.

Metastases are present in the liver.

MICROSCOPIC SECTIONS of this growth show the structure of a bronchial carcinoma (oat seed type).

C A S E 71.

AGE: 58 years.

UNDERGROUND SERVICE: 23 years.

MAIN FEATURES OF CLINICAL EXAMINATION (3 months before death). Weighs 150 pounds. Has lost 15 pounds in the last 10 months. Frequent haemoptysis. Is very short of breath. Sputum negative for tuberculosis.

RADIOLOGICAL REPORT: (3 months before death). There is a generalised fibrosis. An opacity is present in the upper zone of the left lung field and the appearances suggest a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged and deeply pigmented and some are fibrosed. Some show infiltration with carcinoma.

PLEURAE are moderately pigmented and show a few palpable plaques.

LUNGS, On section show a moderate increase in pigment aggregated in discrete islets, an occasional one of which is palpable. There is no overt tuberculosis. A large bronchogenic carcinoma is present in the left apex. There is a moderate degree of chronic bronchitis. Metastases are present in the liver.

MICROSCOPIC SECTIONS of this lung shows the structure of an oat celled carcinoma.

C A S E 72.

AGE: 65 years.

UNDERGROUND SERVICE: 21 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (One month before death). Weighs 158 pounds. Has lost 9 pounds in the last year. Coughs frequently with an occasional haemoptysis. Is very short of breath.

RADIOLOGICAL REPORT: (one month before death). There is no evidence of silicosis. An opacity has been noted in the left mid zone for the last 8 months. Appearances suggest a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged and deeply pigmented but are not fibrosed. Some on the left side are infiltrated with tumour.

PLEURAE are moderately pigmented but show no palpable plaques.

LUNGS. On section show a moderate increase in pigment but no evidence of silicosis. There is no overt tuberculosis in the lung substance. Primary bronchogenic carcinoma is present in the left side.

MICROSCOPIC SECTIONS of this lung show the structure of a bronchogenic oat celled carcinoma.

C A S E 73.

AGE: 50 years.

UNDERGROUND SERVICE: 30 years (including 19 years service in Rhodesia).

MAIN FEATURES OF CLINICAL EXAMINATION: (6 years before death). Is short of breath. Coughs up yellow sputa. Sputum negative for tuberculosis.

RADIOLOGICAL REPORT: (6 years before death). Has a generalised fibrosis with evidence of infection. The appearances are those of a tuberculo-silicosis.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged and deeply pigmented. Some are densely fibrosed. Some show infiltration by malignant neoplasm.

PLEURAE are markedly pigmented but show no plaque formation. These are largely obscured by fibrous adhesions.

LUNGS. On section show a moderate increase in pigment aggregated in discrete islets, a few of which are palpable and in one or two small massive areas of tuberculo-silicosis at the left apex. There is no overt tuberculosis. Chronic bronchitis, emphysema and broncho-pneumonia are present in both lungs. The right lung shows the presence of a gross infiltration by bronchogenic carcinoma.

HEART is small and atrophic.

MICROSCOPIC SECTIONS of lung tissue show the presence of an oat cell bronchogenic carcinoma.

C A S E 74.

AGE: 51 years.

UNDERGROUND SERVICE: 23 years.

MAIN FEATURES OF CLINICAL EXAMINATION. (2 months before death). Weighs 138 pounds and has lost 2 pounds in the last few months. Coughs up a dark yellow sputum. Had an occasional haemoptysis. Two months ago was in bed with a left sided pneumonia.

RADIOLOGICAL REPORT: (2 months before death). There is a generalised fibrosis with silicotic mottling in both lung fields. An opacity is present both in the upper and lower thirds of the left lung field. The lower opacity is probably due to a pleural effusion which has become encysted whilst the upper suggests a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS on the right side are moderately enlarged and deeply pigmented. Root glands on the left side are infiltrated by malignant neoplasm.

PLEURAE are moderately pigmented and show the presence of some palpable plaque formation. A few thin tags of fibrous adhesions are present on both sides and metastatic deposits of malignant neoplasm are present on the pleurae.

LUNGS. On section show a moderate increase in pigment aggregated in discrete islets a few of which are palpable in both lungs. There is no overt tuberculosis. Chronic bronchitis is present in both lungs and a malignant neoplasm is present in the left lung which also shows the presence of pneumonic consolidation.

HEART is small and atrophic.

(N.B. Died after an accident as a result of a fractured skull)

MICROSCOPIC SECTIONS shows the presence of an oat celled carcinoma.

C A S E 75.

AGE: 48 years.

UNDERGROUND SERVICE: 12 years.

MAIN FEATURES OF CLINICAL EXAMINATION: Miner did not attend the Bureau for 14 years before his death.

RADIOLOGICAL REPORT: (14 years before death). Generalised fibrosis is present.

POST-MORTEM REPORT:

ROOT GLANDS are enlarged, some are deeply pigmented. Others show secondary carcinomatous infiltration. All glands are fibrosed.

PLEURAE show a very marked increase in pigment, numerous plaques are palpable and there is much scarring. A moderate number of tags of adhesions are present.

LUNGS on section show a marked increase in pigment aggregated in a moderate number of medium and large sized palpable islets. In addition there are massive areas of fibrosis at the right apex and along the posterior aspect of the left lung. In the right lung there is carcinomatous infiltration of the root area and the greater part of the apical lobe. The basal lobe of the right lung is the seat of septic bronchopneumonia. Slight marginal emphysema and marked bronchitis are present.

HEART shows no significant lesion.

MICROSCOPIC SECTIONS of root glands and of the right apical lobe show the presence of an oat seed type of carcinoma which has probably originated in one of the right upper bronchi.

C A S E 76.

AGE: 41 years.

UNDERGROUND SERVICE: 15 years.

MAIN FEATURES OF CLINICAL EXAMINATION (6 months before death). Weighs 143 pounds. Has lost 7 pounds in last 6 months. Is very short of breath.

RADIOLOGICAL REPORT: (6 months before death). No evidence of silicosis. No evidence of any lung pathology.

POST-MORTEM REPORT:

ROOT GLANDS are the seat of tumour as also are the mediastinal glands. Tumour is present in the right lung and extensive infiltration of the right pleurae is present.

No evidence of silicosis or tuberculosis.

MICROSCOPIC SECTIONS from this lung show a columnar celled adeno carcinoma.

C A S E 77.

AGE: 49 years.

UNDERGROUND SERVICE: 5 years.

This case was not seen by the Bureau for 12 years before his death.

RADIOLOGICAL REPORT: (12 years before death) Large silicotic mottling is present in both lung fields. There is no other evidence of lung pathology.

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged, moderately pigmented and densely fibrosed. There is well marked chronic periadenitis.

PLEURAE show moderate pigmentation with numerous irregular palpable plaques diffusely distributed over both lungs. There are tags of fibrous adhesions over both lungs, particularly over the right lung.

LUNGS. Sections of the lungs show moderately marked pigment with numerous large palpable islets throughout both lungs. In the right bronchus is a carcinoma which is infiltrating into the apical lobe. In both lungs there is septic broncho-pneumonia. There is no overt tuberculosis. Well marked chronic bronchitis and emphysema are present.

HEART shows hypertrophy and dilatation of the right

side and a slight degree of atheroma of the coronary vessels.

MICROSCOPIC SECTIONS show squamous carcinoma of the bronchus.

C A S E 78.

AGE: 60 years.

UNDERGROUND SERVICE: 8 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (4 months before death). Has a moderate cough with clear sputum. Is very short of breath. Weighs 133 pounds and has lost 22 pounds in the last 3 months.

RADIOLOGICAL REPORT: (4 months before death). A pleural effusion is present on the right side which is associated with hilar enlargement, first noted 6 month previously. There is no evidence of silicosis.

POST-MORTEM REPORT:

ROOT GLANDS on the right side are much enlarged, moderately pigmented, moderately fibrosed and extensively infiltrated by tumour. On the left side glands are moderately enlarged and pigmented.

PLEURAE. Right lung has dense adhesions. Left pleura shows moderate pigmentation but no plaque formation. Tags of adhesions are present.

LUNGS. Section of the lung shows moderate pigmentation but no evidence of silicosis. There is no overt tuberculosis. In the right bronchus is a carcinomatous infiltration. Well marked chronic bronchitis but no significant emphysema. A bronchopneumonia

is present in the right lung.

HEART is small and atrophic. Coronary vessels show slight atheroma.

MICROSCOPIC SECTIONS of tumour show it to have the structure of oat cell carcinoma of the lung.

C A S E 79.

AGE: 50 years.

UNDERGROUND SERVICE: 5 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (6 months before death). Weighs 133 pounds. Has lost 7 pounds in the last year. Is a little short of breath. Had an attack of pleurisy two months before this examination.

RADIOLOGICAL REPORT: (6 months before death). There is no evidence of silicosis. Some pleural thickening is present on the left side and a straight X-ray view does not give any indication of the underlying pathology.

POST-MORTEM REPORT:

ROOT GLANDS in the right side are slightly enlarged, moderately pigmented and slight fibrosed. On the left side there is tumour infiltration and the glands are white and hard.

PLEURAE. Over the base of the left lung pleura is densely adherent and thickened. Right pleura shows moderate increase in pigment but no plaque formation.

LUNGS. Section of lung shows moderate increase in pigment but no evidence of silicosis. There is no overt tuberculosis. In the left bronchus is tumour formation(carcinoma) and a broncho-pneumonia at the

left base.

HEART shows no significant lesion.

MICROSCOPIC SECTIONS show a carcinoma, the cellular structure of which suggests an origin from a bronchus.

C A S E 80.

AGE: 69 years.

UNDERGROUND SERVICE: 12 years.

This miner was not seen by the Bureau for 9 years before his death.

RADIOLOGICAL REPORT: (9 years before death). No evidence of silicosis. There is no evidence of any pathology in the chest.

POST-MORTEM REPORT:

ROOT GLANDS are pigmented but not fibrosed. Glands are infiltrated with tumour.

PLEURAE over the right lung show some increase in pigment with an occasional plaque.

SECTION of the right lung shows increase in pigment but no palpable nodules.

LEFT BRONCHUS shows evidence of a bronchial carcinoma, which has infiltrated the oesophageal wall. Metastases are present in both lungs.

No evidence of tuberculosis or silicosis.

C A S E 81.

AGE: 49 years.

UNDERGROUND SERVICE: 5 years.

This miner was not seen by the Bureau for 14 years before his death.

RADIOLOGICAL REPORT: (14 years before death) No evidence of any pathology in the chest.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, moderately pigmented and moderately fibrosed. On the left side they are extensively infiltrated with tumour. There is a moderate degree of chronic periadenitis.

PLEURAE show moderate pigmentation but no plaque formation. There is slight scarring at the apices and there are tags of adhesions over the left basal lobe.

LUNGS. Section of the lungs shows moderate pigmentation but no evidence of silicosis. There is no overt tuberculosis. In the left main bronchus is carcinoma infiltrating mainly the basal lobe. In the lung tissue is moderate degree of chronic bronchitis and there is commencing pneumonia in the left basal lobe. There is moderate emphysema.

Metastases are present in the liver.

MICROSCOPIC SECTIONS of the growth in the lung - lymph nodes and thyroid show the structure of oat seed carcinoma of a bronchus.

C A S E 82.

AGE: 63 years.

UNDERGROUND SERVICE: 1 years.

This miner was not examined by the Bureau for 8 years before his death.

RADIOLOGICAL REPORT: (8 years before death). No evidence of any pathology in the chest.

POST-MORTEM REPORT:

ROOT GLANDS. On the right side are much enlarged and the seat of tumour infiltration. On the left they show moderate pigmentation, moderate fibrosis and some calcification. Mediastinal glands and cervical glands are extensively infiltrated by tumour.

PLEURAE. Right pleura is much thickened and is the seat of carcinomatous infiltration. A small nodule of carcinoma is present in the left apex. Left pleura shows moderate increase in pigment but no plaque formation.

LUNGS. Section of the lung shows moderate increase in pigment but no evidence of silicosis. There is no overt tuberculosis. At the bifurcation of the trachea and in the right main bronchus is an extensive carcinomatous infiltration. This has extended into the right lung involving both apical and basal lobes. In the

right lung is a septic broncho-pneumonia. Left lung is oedematous. Well marked chronic bronchitis is present.

HEART. Tumour has infiltrated the pericardium and is present round the organ of the large vessels.

Heart shows brown atrophy.

MICROSCOPIC SECTIONS of this growth shows the structure of a carcinoma of the bronchus (oat seed type).

C A S E 83.

AGE: 64 years.

UNDERGROUND SERVICE: 5 years.

This miner has not been examined by the Bureau for the past 20 years.

RADIOLOGICAL REPORT: (20 years before death). No evidence of any pathology in the chest.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, moderately pigmented and slightly fibrosed. Some show tumour infiltration on the left side.

PLEURAE show pigmentation but no plaque formation. Nodules of tumour are present on both sides. There are fibrous adhesions at the right base and fibrinous exudate.

LUNGS. Section of the lungs shows slight to moderate pigmentation but no evidence of Silicosis. There is no overt tuberculosis. In the upper bronchus of the left lung there is primary carcinoma and there are metastatic nodules in both lungs. Pneumonic consolidation is present in the basal lobes. Marked chronic bronchitis but no significant emphysema.

HEART shows a malignant pericarditis with nodules of tumour on the surface of the heart.

MICROSCOPIC SECTIONS of the growth of the lung show the structure of a squamous carcinoma of bronchial origin.

C A S E 84.

AGE: 50 years.

UNDERGROUND SERVICE: 16 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (2 years before death). Weighs 204 pounds. Has lost 3 pounds in the last 6 months. No complaints. Nothing abnormal to note on physical examination.

RADIOLOGICAL REPORT: (2 years before death). There is no evidence of Silicosis and no evidence of any other pathology in either lung field.

POST-MORTEM REPORT:

RIGHT LUNG: 1190 gms. LEFT LUNG: 950 gms. HEART 390 gms.

ROOT GLANDS are much enlarged and pigmented but are not definitely fibrosed. They are infiltrated by new growth.

PLEURAE show marked pigmentation but no plaque formation. Malignant haemorrhagic pleurisy is present on the left side and malignant permeation of lymphatics is present in the pleura of the right side. There are a few tags of fibrous adhesions.

LUNGS. On section show a slight increase in pigment but no evidence of silicosis. There is no overt tuberculosis. Bronchial carcinoma is present in the left lung with extensive permeation of the lymphatics

on the left lung and slight permeation in the right lung.

HEART shows marked coronary disease and evidence of malignant pericarditis.

MICROSCOPIC SECTIONS of the left lung show the presence of an oat cell carcinoma with extensive lymphatic permeation in lung tissue, pleurae and pericardium.

C A S E 85.

AGE: 69 years.

UNDERGROUND SERVICE: 5 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (one year before death). Weighs 143 pounds. Has lost 5 pounds during the past 6 months. Coughing a lot. Is very short of breath.

RADIOLOGICAL REPORT: (9 months before death). There is no evidence of silicosis. An opacity is present in the right mid zone and appearances suggest a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG: 800 gms. LEFT LUNG: 630 gms. HEART: 450 gms.

ROOT GLANDS are enlarged, moderately pigmented and on the right side extensively infiltrated by tumour.

PIEURAE show moderate pigmentation but no plaque formation. There are adhesions over the right apical lobe.

LUNGS. Section of the lungs shows moderate pigmentation but no evidence of silicosis or of overt tuberculosis. There is a carcinoma of the right bronchus with extensive infiltration of the apical lobe of the right lung. There is well marked chronic bronchitis and emphysema. Basal lobes are congested.

HEART shows a malignant pericarditis.

MICROSCOPIC SECTIONS of this lung tissue show the presence of a squamous carcinoma of bronchial origin.

C A S E 86.

AGE: 65 years.

Case has not been examined by the Bureau for 15 years before his death.

RADIOLOGICAL REPORT: (15 years before death). No evidence of any pathology in the chest.

POST-MORTEM REPORT:

RIGHT LUNG: 420 gms. LEFT LUNG: 1100 gms. HEART: 480 gms.

ROOT GLANDS on the left side are much enlarged and infiltrated by tumour, on the right there is pigmentation and slight fibrosis.

PIEURAE on the left much thickened by tumour infiltration, on the right there is pigmentation but no plaque formation. At the apex there is scarring.

LUNGS. Section of the lungs shows slight pigmentation but no silicosis, and no overt tuberculosis. The major portion of the left lung is infiltrated by a carcinomatous tumour.

HEART. Pericardium is infiltrated by tumour.

MICROSCOPIC SECTIONS OF THIS LUNG TISSUE show the presence of an oat cell carcinoma.

C A S E 87.

AGE: 60 years.

UNDERGROUND SERVICE: 23 years.

This case was not examined by the Bureau for 14 years before his death.

RADIOLOGICAL REPORT: (14 years before death). A generalised fibrosis is present in both lung fields.

POST-MORTEM REPORT:

RIGHT LUNG: 770 grams. LEFT LUNG: 550 grams. HEART 270
grams.

ROOT GLANDS are moderately enlarged, pigmented and densely fibrosed. There is a well marked chronic periaadenitis.

PLEURAE. Over left lung pleura is thickened and adherent. Right pleura shows pigmentation with irregular plaque formation.

LUNGS. Section of the lungs shows moderate pigmentation with areas of infective silicosis in the apical lobes and irregular islets irregularly distributed throughout the lungs. There is no overt tuberculosis. In the left lung is a carcinoma of the bronchus and a broncho-pneumonia.

A well marked chronic bronchitis is present.

HEART is atrophic. Coronary vessels show atheroma.

OPINION. There is a moderate degree of silicosis in the lungs and this was not a factor in the cause of death.

MICROSCOPIC SECTIONS of this lung tissue show the presence of an oat cell carcinoma.

There are metastases in the liver and brain.

C A S E 88.

AGE: 56 years.

UNDERGROUND SERVICE: 12 years.

MAIN FEATURES OF CLINICAL EXAMINATION (6 months before death). Weighs 126 pounds. Has lost 6 pounds in the last 6 months. Is short of breath. Sputum is blood-streaked.

RADIOLOGICAL REPORT: (6 months before death). There is no evidence of any pathology in the chest.

POST-MORTEM REPORT:

RIGHT LUNG: 1000 grams. LEFT LUNG: 850 grams. HEART 350 grams.

ROOT GLANDS are slightly enlarged and deeply pigmented and some are fibrosed.

PLEURAE are moderately pigmented but show no palpable plaques. Chronic pleurisy is present on the left side.

LUNGS On section show a moderate increase in pigment, but no evidence of silicosis. A large cavity is present at the left apex. Hypostatic consolidation is present in both bases. There is no overt tuberculosis in the lung substance.

BRONCHI are congested.

HEART is not enlarged.

MICROSCOPIC SECTIONS of the left lung show an acutely inflamed bronchiectatic cavity in the walls of which there is infiltration by spheroidal celled carcinoma of bronchogenic type.

C A S E 89.

AGE: 52 years.

UNDERGROUND SERVICE: 24 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (4 months before death). Is very short of breath. Had repeated attacks of haemoptysis. Weighs 174 pounds. Has put on one pound in weight during the past 6 months.

RADIOLOGICAL REPORT: (4 months before death). There is a generalised fibrosis in both lung fields. An opacity is present in the right mid zone and the appearances suggest a primary bronchial carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG: 770 grams. LEFT LUNG: 500 grams. HEART 370
grams.

ROOT GLANDS are moderately enlarged and deeply pigmented. Some are partially fibrosed.

PLEURAE are moderately pigmented and show one or two palpable plaques. Tags of fibrous adhesions are present on the right side.

LUNGS. On section show a moderate increase in pigment aggregated in discrete islets one or two of which are just palpable. There is no overt tuberculosis. Bronchopneumonic consolidation and bronchiectasis are present in the right upper lobe and there is generalised chronic bronchitis.

HEART shows slight hypertrophy and also evidence of dilatation. The cardiac muscle is soft and flabby. Marked atheromatous change with ulceration and calcification are present in the coronary vessels and in the aorta.

MICROSCOPIC SECTIONS of this tissue from the upper lobe and the right lung show diffuse infiltration by malignant neoplasm. The histological features of which suggest epithelial origin.

Metastases are present in the liver.

C A S E 90.

AGE: 66 years.

UNDERGROUND SERVICE: 5 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (one year before death). Weighs 126 pounds and has lost 10 pounds during the last 6 months. Nothing abnormal noted on physical examination.

RADIOLOGICAL REPORT: (one year before death). There is no evidence of silicosis. An opacity is present extending up from the left hilar region and appearances suggest a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG: 670 gms. LEFT LUNG: 780 gms. HEART 360 gms.

ROOT GLANDS are enlarged, pigmented and fibrosed.

PLEURAE show pigmentation with occasional irregular plaque formation and nodules of tumour on surface.

LUNGS. On section show moderate pigmentation but no evidence of silicosis or overt tuberculosis. In the left lung there is extensive tumour infiltration, with metastatic nodules in both lungs.

HEART is small and somewhat atrophic. Vessels show traces of atheroma.

MICROSCOPIC SECTIONS of left lung show the presence

of a primary bronchogenic carcinoma and numerous metastases in both lungs.

C A S E 91.

AGE: 61 years.

UNDERGROUND SERVICE: 11 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (9 months before death). Has a dry cough. Is very short of breath. Has lost 23 pounds in weight during the last 10 months.

RADIOLOGICAL REPORT: (9 months before death). There is a generalised fibrosis associated with silicotic mottling in both lung fields. There is an opacity at the base of the left lung which may be due to a carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged and deeply pigmented and densely fibrosed. Some are calcified. Some show definite tuberculo-silicosis.

PLEURAE are moderately pigmented and show a moderate number of palpable plaques.

LUNGS. On section show a moderate increase in pigment aggregated (1) discrete islets a moderate number of which are palpable (2) a large area of conglomerate tuberculo-silicosis at the left base. There is a moderate degree of chronic bronchitis.

HEART shows a fibrinous pericarditis.

OPINION: There is a moderate degree of silicosis which may have been a factor in the cause of death.

MICROSCOPIC SECTIONS of the left lung tissue show the presence of a grossly necrotic neoplasm in which the few surviving cells have the histological features of a squamous carcinoma of bronchial origin.

C A S E 92.

AGE: 61 years.

UNDERGROUND SERVICE: 25 years.

MAIN FEATURES OF CLINICAL EXAMINATION (5 months before death). Is very short of breath. Coughs up a blood streaked sputum. Weighs 122 pounds and has lost one pound since the last examination 6 months previously.

RADIOLOGICAL REPORT: (5 months before death). There is no evidence of silicosis. At the apex of the left lung is an opacity with appearance suggestive of a carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG: 840 gms. LEFT LUNG: 740 gms. HEART: 280 gms.

ROOT GLANDS are moderately enlarged, moderately pigmented and densely fibrosed. There is a well marked chronic periadenitis.

PLEURAE show moderate pigmentation but no plaque formation. Over the left apical lobe is malignant infiltration.

LUNGS. On section show moderate pigmentation but no evidence of silicosis or of overt tuberculosis. In the right apex is a fibro-cretaceous focus. On the left apical lobe at the periphery is a malignant tumour - sections are being cut to determine the nature. The

lungs are congested and oedematous. There is a moderate degree of chronic bronchitis.

HEART shows atrophic changes. Coronary vessels are atheromatous.

MICROSCOPIC SECTIONS of the apical portion of the left lung show the presence of a squamous carcinoma of bronchial origin.

Metastases are present in the skull.

C A S E 93.

AGE: 79 years.

UNDERGROUND SERVICE: 5 years.

This case has not been examined by the Bureau for 20 years before his death.

RADIOLOGICAL REPORT: (As an "Initial" miner who first went underground 20 years before his death). Normal Thorax.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, pigmented and fibrosed and there is a well marked chronic adenitis.

PLEURAE. Over the left lung is a gross haemorrhagic exudate with features suggestive of tumour. Sections of this are being cut for microscopic examination. There is a moderate pigmentation with sparse palpable plaque formation and there is scarring at the right apex.

LUNGS. Sections of the lungs show slight to moderate pigmentation. No silicosis. No overt tuberculosis. Left lung is collapsed. There is a chronic bronchitis and a moderate degree of emphysema.

HEART small and atrophic. Coronary vessels are sclerosed and show evidence of calcification.

MICROSCOPIC SECTIONS of the pleurae show the presence of an endothelioma.

C A S E 94.

AGE: 60 years.

UNDERGROUND SERVICE: 11 years.

MAIN FEATURES OF CLINICAL EXAMINATION (7 months before death). Is very short of breath. Has a paraplegia. (X-rays of the spine showed the presence of metastases) Sputum examination for tuberculosis negative. (This included culture examination of the Sputa). X-ray examination of the ribs 8 months prior to the first radiological report of bronchogenic carcinoma of the lung showed a fracture of the 6th - 10th ribs on the left side.

RADIOLOGICAL REPORT: (7 months before death). There is no evidence of silicosis. There is an opacity in the upper third of the lung field on the left side and this has been noted for the past 2 years. Appearances suggest a primary bronchogenic carcinoma.

POST-MORTEM:

ROOT GLANDS are moderately enlarged and deeply pigmented. They are partially fibrosed on the left side and show metastatic deposits of malignant neoplasm.

PLEURAE. On section show a moderate increase in pigment but no evidence of silicosis. A malignant neoplasm with cavitation is present in the left lung. Both

lungs show the presence of extensive broncho-pneumonia.

HEART is atrophic. There is calcification of coronary orifice on the left side.

MICROSCOPIC SECTIONS of this specimen from the lung show the presence of oat cell carcinoma.

Section of the root gland shows metastatic deposits of the same tumour.

C A S E 95.

AGE: 60 years.

UNDERGROUND SERVICE: 5 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (3 months before death). Weighs 113 pounds. Has lost one pound in weight during the last six months. Has a slight cough. Sputum is dark yellow in colour. Is very short of breath. Palpable hard glands in the right axilla and also in the cervical region on the right side.

RADIOLOGICAL REPORT: (3 months before death). There is no evidence of silicosis. There is an opacity in the right lung field due to collapse of the right lung and this is probably associated with a carcinoma of the lung.

POST-MORTEM REPORT:

RIGHT LUNG: 1040 gms. LEFT LUNG: 580 gms. HEART 230 gms.

ROOT GLANDS show moderately marked enlargement, moderate pigmentation, fibrosis, foci of calcification and infiltration by tumour.

PLEURAE left pleura shows pigmentation but no plaque formation. Over right lung pleura is thickened.

LUNGS. Section of the lungs show moderate pigmentation but no evidence of silicosis or of overt tubercu-

losis. The right lung is somewhat collapsed and there is extensive infiltration in the lung by carcinoma. In the basal lobe there is broncho-pneumonia.

HEART shows atrophy.

MICROSCOPIC SECTIONS of the right lung show: the presence of a primary bronchogenic carcinoma.

C A S E 96.

AGE: 48 years.

UNDERGROUND SERVICE: 12 years.

MAIN FEATURES OF CLINICAL EXAMINATION (5 months before death). Weighs 136 pounds and has lost 10 pounds during the previous 6 months. Coughs a great deal, the sputum being blood streaked. Is very short of breath.

RADIOLOGICAL REPORT: (5 months before death). There is no evidence of silicosis. There is an enlargement of the right hilar region which has been noted for the past year. There is now a fairly well marked opacity in the right mid zone. Appearances suggest a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, pigmented and fibrosed. There is a moderate degree of chronic periaadenitis.

PLEURAE. There are dense adhesions over the right lung. There is pigmentation but no plaque formation.

LUNGS. Section of the lung shows moderate pigmentation but no evidence of silicosis. There is no overt tuberculosis. In the right bronchus is a carcinomatous

ulcer, round which there is purulent infiltration. Adhesions are present throughout the right lung. In the left one finds bronchitis and emphysema, hypostatic congestion and oedema.

HEART is small and atrophic.

MICROSCOPIC SECTIONS of the growth in the right main bronchus shows the structure of a squamous carcinoma.

MICROSCOPIC SECTIONS of the growth on the anterior aspect of the left arm show the structure of a squamous carcinoma.

SECTION of root glands shows presence of tuberculo-silicosis but no sign of definite active tuberculosis.

C A S E 97.

AGE: 59 years.

UNDERGROUND SERVICE: 17 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (7 months before death). Weight 142 pounds. Has lost 21 pounds in the past year. Is very short of breath. Has a dry cough.

RADIOLOGICAL REPORT: (7 months before death). There is no evidence of silicosis. There is an opacity at the base of the left lung field due to pleural thickening.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged and deeply pigmented and some are fibrosed. Some show secondary carcinoma.

PLEURAE are moderately pigmented and show an occasional palpable plaque. Chronic pleurisy is present on the right side.

LUNGS. On section show moderate increase in pigment but no evidence of silicosis. There is no overt tuberculosis in the lung substance. A bronchogenic carcinoma is present in the left hilum. Bronchial obstruction is present with a large basal bronchiectatic cavity and septic broncho-pneumonia.

HEART is slightly enlarged.

MICROSCOPIC SECTIONS of lung show the structure of a squamous carcinoma.

C A S E 98.

AGE: 62 years.

UNDERGROUND SERVICE: 17 years.

MAIN FEATURES OF CLINICAL EXAMINATION (6 months before death). Dry cough. Very short of breath. Weighs 148 pounds and has lost 3 pounds in the last 6 months.

RADIOLOGICAL REPORT: (6 months before death). A generalised fibrosis is present. There is an opacity at the right base which has been noted for the last 16 months. Appearances are suggestive of a primary lung carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are much enlarged, deeply fibrosed, moderately pigmented and infiltrated with tumour.

PLEURAE. There is a malignant pleurisy over the right lung. There are adhesions over the left.

LUNGS. Sections of the lungs show moderate pigmentation but no evidence of silicosis or tuberculosis. There is a carcinoma at the root of the right lung and a large metastatic nodule in the middle lobe. There is a well marked chronic bronchitis.

HEART is atrophic. Coronary vessels show patchy atheroma.

MICROSCOPIC SECTIONS of these lungs show the presence

of a few small and medium sized islets of silicotic fibrosis. There is no sign of active tuberculosis. In addition the lung tissue shows infiltration by a squamous carcinoma of bronchial origin.

C A S E 99.

AGE: 64 years.

UNDERGROUND SERVICE: 14 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (one month before death). Weighs 172 pounds and has lost 18 pounds during the past 6 months. The X-ray findings were confirmed by a bronchoscopic examination and a pneumonectomy of the right lung was performed. The patient, however, died of broncho-pneumonia.

RADIOLOGICAL REPORT: (one month before operation). There is no evidence of silicosis. There is an enlargement of the right hilar region and appearances suggest a primary bronchial carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG removed by operation showed a carcinoma of the bronchus.

LEFT LUNG. ROOT GLANDS enlarged, pigmented and fibrosed.

PLEURA shows moderate pigmentation with some irregular plaque formation and scarring.

LUNG. Section of the lung shows moderate pigmentation. There is no overt tuberculosis. There is a moderate degree of chronic bronchitis and emphysema. An extensive acute broncho-pneumonia is present.

HEART. Coronary vessels show atheroma.

C A S E 100.

AGE: 61 years.

UNDERGROUND SERVICE: 35 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (14 months before death). Weighs 159 pounds having lost 7 pounds in the last 6 months. Is very short of breath. Sputum is blood streaked.

RADIOLOGICAL REPORT: (14 months before death). There is a generalised fibrosis. A large opacity is present in the right upper third and appearances suggest a primary bronchial carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS show moderate increase in pigment with sparse irregular plaque formation.

PLEURAE: Over the whole of the right apical lobe is tumour infiltration.

LUNGS. Section of the lung shows moderate increase in pigment with occasional palpable small islets in the apical lobe and a small massive area in the right apical lobe which is extensively infiltrated by tumour. There is no overt tuberculosis. Well marked chronic bronchitis is present.

HEART shows no significant lesion.

MICROSCOPIC SECTIONS of the growth of the lung show the structure of a carcinoma with features suggestive of a primary bronchial origin.

C A S E 101.

AGE: 56 years.

UNDERGROUND SERVICE: 23 years.

This miner was examined for the first time 20 years before his death and did not again appear for a clinical examination.

RADIOLOGICAL REPORT (20 years before death). Normal thorax.

POST-MORTEM REPORT:

RIGHT LUNG: 870 gms. LEFT LUNG: 430 gms. HEART: 220 gms.

ROOT GLANDS are moderately enlarged, pigmented and fibrosed: some show tumour infiltration.

PLEURAE There are dense adhesions over the left lung - tumour infiltration is present. There is moderate pigmentation but no plaque formation. At the apices is scarring.

LUNGS. Section of the lungs shows moderate pigmentation with an occasional palpable islet. There is no overt tuberculosis. There is well-marked chronic bronchitis. In the left lung there is extensive carcinoma-tous infiltration. The right lung is oedematous.

HEART shows atrophy.

MICROSCOPIC SECTIONS of the left lung show the presence of an adeno-carcinoma. Metastases are present in the liver.

C A S E 102.

AGE: 51 years.

UNDERGROUND SERVICE: 13 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (6 months before death). Weighs 119 pounds having lost 3 pounds in the last 6 months. Is short of breath. Sputum is blood streaked.

RADIOLOGICAL REPORT: (6 months before death). There is no evidence of silicosis. An opacity is present in the upper and lower thirds of the right lung field. This has been noted for the past year and appearances suggest a primary lung carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG: 970 gms. LEFT LUNG: 590 gms. HEART: 360 gms.

ROOT GLANDS are moderately enlarged, moderately pigmented and fibrosed - on the right side they are infiltrated by tumour.

PLEURAE show moderate pigmentation with a few irregular palpable plaques and scars particularly at the apices.

LUNGS. Section of the lungs show moderate pigmentation but no evidence of silicosis or of overt tuberculosis. At the root of the right lung and in the trachea there is carcinomatous infiltration. There is well marked

chronic bronchitis and emphysema - patchy consolidation is present in the right basal lobes.

HEART. Coronary vessels show sclerosis and patchy atheroma.

MICROSCOPIC SECTIONS of the right lung show the presence of a primary bronchogenic carcinoma.

C A S E 103.

AGE: 53 years.

UNDERGROUND SERVICE: 9 years.

This case was examined 21 years before the date of his death and did not again appear before the Bureau for a clinical examination.

RADIOLOGICAL REPORT: (21 years before death). Normal thorax.

POST-MORTEM REPORT:

ROOT GLANDS are moderately enlarged, deeply pigmented but are not fibrosed.

PLEURA show moderate pigmentation but no plaque formation. Fibrous adhesions are present on the right side and a fibrinous exudate of the left pleura.

LUNGS Section of the lungs shows a moderate increase in pigment and one or two islets are palpable in the left apical lobe. A malignant neoplasm involves the left main bronchus and the left lung is the seat of a septic broncho-pneumonia and bronchiectasis.

HEART shows no significant lesion.

MICROSCOPIC SECTIONS of this growth of the bronchus show the structure of an oat cell carcinoma.

C A S E 104.

AGE: 56 years.

UNDERGROUND SERVICE: 29 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (8 months before death). Weighs 174 pounds having lost 4 pounds in the last 6 months. Is very short of breath. Coughs up a dark yellow sputum.

RADIOLOGICAL REPORT: (8 months before death). A generalised fibrosis is present but there is no other evidence of pathology.

POST-MORTEM REPORT:

RIGHT LUNG: 1480 gms. LEFT LUNG: 1060 gms. HEART 430 gms.

ROOT GLANDS are much enlarged, deeply pigmented and densely fibrosed and some show extensive tumour infiltration.

PLEURAE show patchy thickening with tags of adhesions and tumour nodules on surface.

LUNGS. On section show moderate pigmentation with moderately numerous irregular palpable islets, but no overt tuberculosis. In the basal lobe of both lungs is extensive tumour infiltration and also in the bronchi. Numerous nodules of tumour are scattered throughout the lungs. There is well marked chronic bronchitis.

HEART is enlarged, with dilatation and hypertrophy of the right side. Coronaries show sclerosis and atheroma.

OPINION: There is a slight degree of silicosis in the lungs and that this probably was not a factor in the cause of death.

MICROSCOPIC SECTIONS of this growth from the lung show the structure of a spheroidal celled bronchogenic carcinoma.

C A S E 105.

AGE: 45 years.

UNDERGROUND SERVICE: 10 years.

This miner was examined by the Bureau 25 years before the date of his death and did not again appear for a clinical examination.

RADIOLOGICAL REPORT: (25 years before death) Normal thorax.

POST-MORTEM REPORT:

ROOT GLANDS are slightly enlarged and fibrosed.

PLEURAE are somewhat pigmented but there is no evidence of any plaque formation. A chronic pleurisy is present on the right side.

LUNGS. On section show a moderate increase in pigment but there is no evidence of sclerosis or of tuberculosis.

A bronchogenic carcinoma is present in the right lung.

MICROSCOPIC SECTIONS of this area show the presence of a squamous carcinoma.

C A S E 106.

AGE: 66 years.

UNDERGROUND SERVICE: 22 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (2 years before death). Weighs 146 pounds and has lost 3 pounds in the last 6 months. Has a moderate cough. Sputum dark yellow in colour. Is very short of breath.

RADIOLOGICAL REPORT: (2 years before death). There is no evidence of silicosis or any other lung pathology.

POST-MORTEM REPORT:

RIGHT LUNG: 680 gms. LEFT LUNG: 580 gms. HEART: 290 gms.

ROOT GLANDS are moderately enlarged, deeply pigmented and densely fibrosed. Some of those on the left side are infiltrated by malignant neoplasm.

PLEURAE are moderately pigmented but show no plaque formation.

LUNGS. On section show a moderate increase in pigment but no evidence of silicosis. There is no overt tuberculosis. A bronchogenic carcinoma is present in the left basal lobe and there is basal broncho-pneumonic consolidation in both bases.

HEART is small and atrophic. No evidence of coronary occlusion has been observed.

MICROSCOPIC SECTIONS of this growth from the left basal lobe show the structure of an oat cell carcinoma. Metastases are present in the liver and in the spine.

C A S E 107.

AGE: 54 years.

UNDERGROUND SERVICE: 13 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (15 months before death). Weighs 150 pounds, having lost 5 pounds in the last 6 months. Is very short of breath. Sputum is blood streaked.

RADIOLOGICAL REPORT: (15 months before death). There is no evidence of silicosis or any other lung pathology.

POST-MORTEM REPORT:

RIGHT LUNG: 1180 gms. LEFT LUNG: 930 gms. HEART: 470 gms.

ROOT GLANDS are moderately enlarged and deeply pigmented but are not fibrosed.

PLEURAE are markedly pigmented and show a few palpable plaques. Chronic pleurisy is present on the right side.

LUNGS. On section show a moderate increase in pigment aggregated in discrete islets, an occasional one of which is palpable. There is no overt tuberculosis. Chronic bronchitis and moderate emphysema are present in both lungs. Bronchopneumonic consolidation is present at the left base. A diffuse consolidation and small cavity are present in the middle and lower lobes

of the right lung. Sections are being cut to determine the nature of the consolidation.

HEART. The left ventricle shows the presence of slight hypertrophy. The coronary vessels show atheroma with narrowing of the lumen.

MICROSCOPIC SECTIONS of this lung tissue show the presence of a bronchogenic adenocarcinoma.

C A S E 108.

AGE: 52 years.

UNDERGROUND SERVICE: 18 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (3 months before death). Has a dry cough and is very short of breath. Weighs 140 pounds and the weight has been stationary for the past year.

RADIOLOGICAL REPORT: (3 months before death). There is no evidence of silicosis. There is an opacity in the left mid zone with appearances suggestive of a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

RIGHT LUNG: 760 gms. LEFT LUNG: 1210 gms. HEART: 340 gms.

ROOT GLANDS are moderately enlarged and moderately pigmented. Some on the left side are partially fibrosed.

PLEURAE are markedly pigmented and show the presence of a few palpable plaques. The left pleura is largely obscured by fibrinous exudate and fibrous adhesions.

LUNGS. On section show a moderate increase in pigment aggregated in discrete islets, an occasional one of which is palpable. There is no overt tuberculosis. Pneumonic consolidation associated with an area of gangrene and haemorrhage are present in the left lung.

The left lung also shows evidence of bronchogenic carcinoma. Emphysema and chronic bronchitis are present in both lungs.

HEART, shows the presence of slight atrophic change.

MICROSCOPIC SECTIONS of this lung tissue show the presence of an oat-celled carcinoma.

C A S E 109.

AGE: 49 years.

UNDERGROUND SERVICE: 24 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (6 months before death). Weighs 256 pounds and the weight has been stationary for the past year. Is very short of breath. Sputum is blood streaked. Had a recent pleurisy on the right side.

RADIOLOGICAL REPORT: (6 months before death) There is a generalised fibrosis but no definite evidence of any other pathology.

POST-MORTEM REPORT:

RIGHT LUNG: 1250 gms. LEFT LUNG: 980 gms. HEART 520 gms.

ROOT GLANDS are moderately to much enlarged and moderately pigmented, but are not fibrosed. They are infiltrated with secondary carcinoma.

PLEURAE are moderately pigmented and show a few palpable plaques.

LUNGS. On section show a moderate increase in pigment aggregated in discrete islets, an occasional one of which is palpable. There is no overt tuberculosis in the lung substance. Bronchogenic carcinoma is present in the right hilum.

HEART is moderately enlarged.

MICROSCOPIC SECTIONS of this bronchogenic growth show the structure of an oat-celled carcinoma.

C A S E 110.

AGE: 62 years.

UNDERGROUND SERVICE: 3 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (3 months before death). Weighs 126 pounds and the weight has remained stationary for the past year. Is very short of breath. Has a dry cough.

RADIOLOGICAL REPORT: (3 months before death). There is no evidence of any silicosis. An opacity is present in the left apical region. Appearances suggest a primary bronchogenic carcinoma.

POST-MORTEM REPORT:

ROOT GLANDS are slightly enlarged and deeply pigmented and some are fibrosed.

PLEURAE are moderately pigmented but show no palpable plaques.

LUNGS. On section show a moderate increase in pigment but no evidence of silicosis. There is no overt tuberculosis in the lung substance. There is a moderate degree of chronic bronchitis. Bronchogenic carcinoma is present extending to the left apex.

HEART is slightly enlarged.

MICROSCOPIC SECTIONS of this bronchogenic growth show the structure of a squamous carcinoma.

C A S E 111.

AGE: 24 years.

UNDERGROUND SERVICE: 4 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (4 months before death). Weighs 158 pounds and has lost 4 pounds in the past 6 months. Coughing a lot and expectorates a purulent offensive fluid. Is very short of breath and has pain on the left side of the chest.

RADIOLOGICAL REPORT: (4 months before death). There is no evidence of silicosis. There is an opacity at the bases of both lung fields and bronchograms are required to confirm the presence of a bronchiectasis.

POST-MORTEM REPORT:

ROOT GLANDS are pigmented but are not fibrosed.

PLEURAE. There is an abundant fibrinous exudate over the right lung.

LUNGS. Section shows slight pigmentation but no evidence of silicosis or overt tuberculosis. There are numerous miliary and submiliary foci throughout the left lung. In the right lung are haemorrhagic foci.

HEART shows no significant lesion.

MICROSCOPIC SECTIONS. There is an adeno-carcinoma of the left lung with miliary carcinomatosis in both lungs.

C A S E 112.

AGE: 43 years.

UNDERGROUND SERVICE: 2 years.

MAIN FEATURES OF CLINICAL EXAMINATION: (2 years before death). Weighs 143 pounds having lost 11 pounds in the last year. Dry cough. Is short of breath.

RADIOLOGICAL REPORT: (2 years before death). No evidence of silicosis or other lung pathology.

POST-MORTEM REPORT:

RIGHT LUNG: 890 gms. LEFT LUNG: 440 gms. HEART: 290 gms.

ROOT GLANDS are much enlarged on the right side and infiltrated by tumour. There is pigmentation and slight fibrosis.

PLEURAE show moderate pigmentation but no plaque formation. Tags of fibrous adhesions are present.

LUNGS. Section of the lungs shows moderate pigmentation but no evidence of silicosis. There is no overt tuberculosis. In the right lung at the root is a carcinoma of the bronchus infiltrating the lung. There is a moderate degree of chronic bronchitis and emphysema. Bronchopneumonia is present in the right base.

HEART is small and atrophic. Coronary vessels show traces of atheroma.

MICROSCOPIC SECTIONS of this lung show the presence

of an oat cell carcinoma.

Metastases are present in the liver, spine and right kidney.

C A S E 113.

AGE: 47 years.

UNDERGROUND SERVICE: 22 years.

(This miner last attended the Bureau 22 years before his death)

RADIOLOGICAL REPORT: (22 years before death) Normal thorax.

POST-MORTEM REPORT:

ROOT GLANDS on the left side are infiltrated with tumour. On the right side they are slightly pigmented and not fibrosed.

PLEURAE On the left side pleura is much thickened and adherent. On the right side it shows slight increase in pigment but no plaque formation.

SECTION OF LUNGS shows a slight increase in pigment but no evidence of silicosis. There is no overt tuberculosis. There is extensive infiltration of the left lung by a malignant growth, both lobes being involved, but particularly the basal lobe in which there is also septic broncho-pneumonia. A moderate degree of chronic bronchitis is present.

HEART shows atrophy and a fatty change in the muscle.

SPLEEN AND PANCREAS show tumour nodules.

MICROSCOPIC SECTIONS show: an oat-seed carcinoma.

C A S E 114.

AGE: 59 years.

UNDERGROUND SERVICE: 26 years.

This miner last attended the Bureau 26 years ago when he was first passed as fit for underground work. There are no records of his having attended the Bureau since that date.

RADIOLOGICAL REPORT: (26 years before death). Normal thorax.

POST-MORTEM REPORT:

ROOT GLANDS show moderate marked enlargement, moderate pigmentation and a dense fibrosis. A marked chronic peri-adenitis is present.

PLEURAE show moderate increase in pigment aggregated in moderately numerous medium sized islets to large sized palpable islets diffusely scattered throughout both lungs. In addition in the sub-apical regions are small areas of massive fibrosis. There is no overt tuberculosis. A primary carcinoma of the right lower bronchus is present and this has extensively infiltrated the lower lobe. A small metastatic focus is present in the left basal lobe. A moderately marked chronic bronchitis is present.

HEART shows well marked fatty degeneration.

MICROSCOPIC SECTION shows the presence of a primary

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